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Vol. VII. NEW YORK, MAY 22, 1886. No. 21.

A PLEASANT little chapter of reminiscences will be found in Dr. Vander Weyde's paper on his early experiences in this city with electro-motors. The worthy doctor is a Nestor among American electricians, and has been an insatiable and unwearying experimentalist all his life. His account of the work he undertook for Peter Cooper will be read with interest by many admirers of that grand old philanthropist.

MR. THOS. D. LOCKWOOD'S paper on long-distance telephony, read this week before the American Institute of Electrical Engineers and given in this issue, is an able presentation of the manner in which the telephonic art is being improved and the long-distance problem solved. Mr. Lockwood shows how experiments have been made with the various plans suggested, and how the matter, through the medium of the American Telephone and Telegraph Company, has been carried out of the region of occasional test into that of every day practice. The task of making long-distance telephony a commercial success is in highly competent hands, and just at this stage it is very interesting to have Mr. Lockwood's account of the work that has been done.

THE country is promised an early close to the Pan-Electric inquiry, and already an outline is given of the committee's majority and minority reports. As was to be expected, the majority report will be of the nature of whitewash, while the minority report will not be wanting in pigments of sombre hue for its picture of official depravity. When the best has been made of a bad case, the exposure is a sorry one for the law officer of a "Reform" administration, and must result in Cabinet changes.

IN an interesting paper read before the Minnesota Academy of Natural Sciences, Mr. N. Kolkin details the results of some curious experiments undertaken by him relative to the changes in direction of vibration experienced by a freely suspended pendulum. Mr. Kolkin credits electricity with being the force at work, and in a private communication to us gives some additional facts which will interest our readers. Thus, he states that the oscillations of pendulums will not change from their original directions in certain kinds of weather, and sometimes there will be a change every three or four minutes, so that oscillations will change for a few minutes, and remain steady for another period of time. He also finds the latter period to coincide with the occurrence of other phenomena, such as the violent oscillation, up and down, of a spiral spring suspended by one end. In the absence of more of the details of these experiments, we refrain from commenting upon the legitimacy of the theory adduced therefrom by Mr. Kolkin, but we coincide with him in the opinion that the subject is well worthy of further investigation, which we hope will be bestowed upon it.

ON another page Mr. Macquarrie reviews the question of the disposition to be made of the over-head wires, and the points he makes, although not new, are brought out with considerable force. It is undoubtedly true that much of the howl raised against the unsightliness of the poles appears absurd and wanton when one recalls the other unæsthetic things that daily greet the vision, and that remain unmolested in all their glaring ugliness. As pointed out, underground electrical work is still in its infancy in this country, as abroad, and is likely to remain so for some time to come. The impression lurks in the minds of many that in Europe underground wires are universal, but we must repeat that so far as any general underground system is concerned, it does not exist anywhere in Europe. Paris, with the advantage of her large sewers, has probably the largest underground system of any city; but even there, by far the greater number of wires are still above ground, and they are likely to remain above. If, as the law says, the wires in the larger cities must go underground, they had better be put there very gradually, in justice to the electrical companies and for the benefit of the public, which grumbles bitterly at every little delay caused by failure to get prompt electrical service. We would therefore advise the wire-buriers to "make haste slowly," though by no means to "mark time."

THE report of a test of his motor, a copy of which Mr. Reckenzaun has kindly sent us, shows that the designer has produced a very efficient machine, which will not fail to have its place and its influence, especially upon the question of underground haulage. This field, promising as it is, has not been attacked with fitting vigor, for we are convinced that with proper attention it can be made to be one of the largest in which electricity is applied, particularly in coal districts. Small coal or "culm" has practically no value at the pit, so that the running expense of the plant is reduced to a minimum. On looking over the tests, it will be seen that a remarkable uniformity of efficiency is obtained through a range of powers varying from 4.98 to 12.32 h.-p. An analysis of the figures also shows that one brake h.-p. is obtained for every 45.4 pounds of material, or one electrical h.-p. for 32.6 pounds of iron, copper, etc. With the varying loads to which electric locomotives are subject, a nearly constant efficiency of 70 per cent. is an important consideration. It will also be noted that Mr. Reckenzaun has adopted an excellent feature, which consists in the fact that he runs his motor with all loads and in either direction with one pair of brushes permanently fixed. Too much importance cannot be attached to these small details, as they combine to make the handling of the apparatus so simple that the ordinary laborer can take charge of it.

IN a communication which appears in another column Dr. Allan V. Garratt comments on the recent article on battery materials by Mr. Fitch, and on one of our recent editorial comments, and brings out forcibly the truth that while every electrician should be well acquainted with the theoretical working values of battery materials, their commercial values must first and always be considered. He observes that the commercial efficiency of the various materials was published by A. Niaudet, in French, some time ago, and would seem to regret that no translation has appeared in English. We may draw attention to the fact that Mr. Sprague, in his excellent work, "Electricity," gives various tables of the working values of substances used in batteries, and among them one on the cost of battery working, taking into consideration both the theoretical and commercial values of the various materials. Unfortunately, these values are given from the standpoint of the cost of material in England, so that the table would have to be revised in order to make it conform to average values here existing. Dr. Garratt also mentions another factor which, however, is not included in any table which we have seen; and that is, the cost of attendance of the batteries. This is quite an important factor, especially where a large number of cells are used, and from the nature of various batteries this factor alone must in many cases decide the adoption or rejection of a particular form. As we have stated on previous occasions, the voltaic battery, while at present overshadowed by the more powerful dynamo, is still open to many developments of importance, and ought not to be neglected. Dr. Garratt's own remarks made at the Baltimore electric light convention in February brought this out with great clearness.

GENERAL MASTER WORKMAN POWDERLY is wrathy because the Cheap Labor Operator got hold of his powerful "secret" circular on the labor question, addressed to the Knights, and, of course, bulled it. His paraphrase, "In the hands of man entirely mouth the gun is harmless as his word," appeared before the public "as harmless as his *sword*." The General Master Workman must be patient, for he does not understand that that is one of the vexations of greatness—the iconoclastic Cheap Operator levels everything. To be killed in battle fighting for your country and then have your name "bulled" in the dispatches is one of the penalties of great deeds. "Do not hang about the new office" is an exasperating dispatch for an employé to receive from his employer; but it is the playful way in which the Cheap Operator delivers the original, "Do *nothing* about the new office." The exasperated Master Workman may yet telegraph for a horse to meet him at the depot, and upon arrival find the traditional "hearse;" or he may yet be heralded forth as heading a mutiny in Scranton, when in fact he had headed a "meeting." He must recall his illustrious predecessors who have sent forth soul-stirring words to the world by telegraph and found what a nice shade of meaning the Cheap Operator could give his grandiloquent phrases. Garfield's famous dispatch, "God reigns and the government at Washington still lives," shocked us all by appearing as "God resigns," etc., and when, upon the deposition of the Sultan, Abdul Aziz, the rebels proceeded to tear him all apart on account of an official message in French from Queen Victoria: "Saignez le bien" (bleed him well), they were only stopped by a repetition of the original message: "Soignez le bien" (*treat* him well) The Cheap Operator only changed an "o" into an "a," but he nearly sealed the fate of an Oriental monarch. The Master Workman now understands probably that when he wants to give a violent wrench to his "secret" circulars, he must scatter them broadcast by telegraph.

IN the concluding portion of Mr. Kintner's interesting lecture, which we have printed in our last two issues, attention is called to the fact that "by a strange chain of circumstances many of the leading and essential features embodied in successful incandescent and arc lighting and also in dynamo machines to-day are public property." So far as arc lighting and dynamo machines are concerned, some may be inclined to agree with Mr. Kintner in his statement, but there are not a few who would probably not be willing to accept it with reference to incandescent lighting. Indeed, when judged by suits now pending, a number of "essential features" in incandescent lighting would seem to be quite the reverse of public property, unless the courts shall decide to that effect. A valuable suggestion made by Mr. Kintner relating to the unwritten history of the patent office deserves consideration. As pointed out by him, many inventions of great practical utility rest in secrecy in the office, having been abandoned by the original inventors, and not until some more fortunate original inventor has succeeded independently in reaching the desired goal will they be resurrected. These abandoned inventions should be published, by all means, after a reasonable time has elapsed to guard the first original inventors, for it is plain that most useful inventions might thus lie useless and in oblivion. Probably some lie buried in the napkin to-day. It is strange that our patent laws contain no provisions meeting this condition of things, but we hope that the attention of Congress may be drawn thereto, and suitable legislation follow. Mr. Kintner pays a glowing tribute to our patent system, and claims rightly that it is the best the civilized world ever knew. So thorough are the searches that, as may not be generally known, applications for patents are frequently filed, especially by foreigners, with the sole object of ascertaining the state of the art, which is revealed by the references cited by the patent office examiners. No higher compliment can be paid to the efficiency of our patent system, and we believe that nowhere is a patent more secure or more fruitful than in the United States.

Some Early Experiences with Electric Motors.*

BY DR. P. H. VANDER WEYDE.

Dr. John William Draper, whose reputation in regard to researches on light and photography had reached beyond the Atlantic, was one of the first scientists upon whom I called after my arrival in New York in 1849. What induced me principally to call was the fact that I had been occupied upon the same line of research, beginning with the time that the French government so liberally gave the beautiful Daguerrean process to the world, after having bought it from Daguerre in 1840 by allowing him a pension for life. From 1849 to 1852 I occupied rooms in the University building, where Dr. Draper was professor of chemistry, and was thus in frequent conversation with him. A strong friendship sprang up between us, of which from time to time he gave me many demonstrations, and which I shall always highly value.

During our conversations, which, of course, were always of a scientific character, I informed him that from 1843 to 1848, stimulated by the successful efforts of Jacobi in St. Petersburg and Wagner in Frankfort, I had occupied myself with practical experiments in constructing electro-motors, consisting in making small working models of various types to the number of 40 or 50, in order to test which form was the most advantageous. I spoke to him of the important results which these tests had upon my opinions in regard to the electrical theories prevalent at that time; it was nothing less than the conviction that the contact theory of Volta was erroneous, and that the source of electric force was not to be found in the contact of heterogeneous metals, but in the consumption of zinc by acids; that my working models had proved to me that the electromotive force developed was the direct ratio of the amount of zinc consumed in the battery, a case similar to that of the steam engine, in which the power developed is in the direct ratio of the amount of coal consumed in the furnace. I added that if we consider the expensiveness of zinc and acids, which are both products of manufacture, and the cheapness of coal, which is a product of nature, while the air which is consumed costs nothing, it was an idle effort to make electricity compete with steam power, as was the dream of investigators at that period; and I held that as long as we had no cheaper source of electricity than consuming zinc or iron with acids, or salts, which costs as much, if not more than, the metal consumed, the construction of electro-motors was useless, and it had been abandoned by me, as I had no idea then where a cheaper source of electricity was to be found.

These conversations with Dr. Draper had, as a result, that he soon introduced me to Mr. Peter Cooper, who, being a wealthy man and a promoter of industrial progress, was often approached by various parties for financial aid in constructing electro-motors as well as other things, and he was in need of advice from a disinterested party, who was well informed on the subject. The outcome was that Mr. Cooper frequently sent me word to examine working models of motors constructed in various parts of the city, but the great majority were brought from other places, and placed on exhibition in some of the hotels. I found most of them defective in construction, frequently equivalent to a confession of ignorance in electrical laws on the part of the inventors; but the best ones simply demonstrated the expensiveness of the attempt to obtain available power by galvanic batteries, while in all cases the inventors did their best to hide the amount of battery power used, and to obstruct the attempts to measure the mechanical power obtained. Invariably I felt obliged to advise adversely, and, while Mr. Cooper was very cautious to invest in uncertain enterpirses, in some instances a great pressure was brought to bear upon him by enthusiastic inventors and their still more enthusiastic friends, to whom he might have yielded if my convictions, in which he appeared to have much confidence, had not prevented it. Those examinations took place off and on during the whole period of the erection of the Cooper Union building, which was completed in 1859, when I was appointed one of the teachers. I believe Mr. Cooper never spent a single dollar on account of electro-motors, except on such small specimens as were required for class instruction in the regular course of lectures in physical science given in the Cooper Union building.

The electro-motors I examined differed greatly in size, from such as occupied scarcely the space of a cubic foot to those of the size of a 50 horse-power steam engine. Among the latter I must mention the motors of three inventors who operated on a large scale, viz., Professor Page, of Washington; Professor Vergnes, of New York, and Mr. Paine, of Newark. I saw Page's engine in operation in New York in 1850. His system is well known among electricians, but deserves special mention for the large scale in which he executed it. It consisted in massive iron plungers which were attracted into coils by alternate currents, and by means of a crank revolved a fly wheel. Vergnes' machine was exhibited at our World's Fair in 1852, in the Crystal Palace on Reservoir Square—now called Bryant Park—and consisted in elongated loops of copper wire revolving between the poles of powerful and colossal electro-magnets. In regard to this machine, I will remark that if he had reversed the function of his machine and revolved the loops by means of steam power, he would have had one of the forms of Siemens' dynamos, and would have solved the problem reserved for the investigators of twenty years later (Pacinotti, Gramme and Siemens), who transformed power into electric currents by the inversion of the function of the motor, as Gramme did with Pacinotti's ring. In fact, one of the little motors which I constructed in 1844 would have been a small dynamo, if revolved with sufficient power and velocity.

For driving their large motors, both Page and Vergnes used proportionally large batteries—large in size as well as in the number of cups. Their batteries were always carefully hidden from view, especially those used by Vergnes, who had in the Crystal Palace several locked rooms which were filled with them.

Paine, of Newark, did not need any battery at all for the exhibition of his motor. He had, however, a small battery connected with his motor, and pretended that this did drive it, together with the circular saw connected with the same. This saw operated with such power that it aroused my suspicions, so I surreptitiously disconnected the battery, and as the saw worked just as well I was convinced that power was obtained from elsewhere. I then discovered that next door there was a factory where steam-power was used, and that Paine's electro-motor was only on exhibition during the working hours of the factory. The whole deception was clear, the only purpose being to sell stock in Mr. Paine's Electro-motor Company, which was kept up for several years, but has been put in the shade by the strong vitality of the Keely motor enterprise of the present day.

As the modern dynamo, as stated before, is in fact nothing but an electro-motor of which the function is reversed (*i. e.*, instead of obtaining power by electricity, the dynamo produced electricity for power applied), the labor spent on the construction of electro-motors has not been in vain, while at the same time the motors themselves have become useful by reason of the cheap electricity furnished by dynamos, which was the great *desideratum*.

Permanent steel magnets alone are as unfit to obtain motion from as is gravitation, and the many attempts made in this direction may be classified with the delusion that perpetual motion may be obtained by gravitation. Still, only a few years ago, a Boston invention of this kind by one Gary was gravely described in *Harper's Monthly*. It consisted in a motor operated by steel magnets alone; the inventor promised to exhibit it in the Polytechnic Club of the American Institute, but nothing came of it.

When electro-magnetism was discovered, and the horse-shoe electro-magnet was invented by Sturgeon, by which a piece of soft iron may be powerfully magnetized and demagnetized by the make and break of a battery circuit, a new direction was given to the efforts to produce motors, and the forms devised were as various as the principles upon which they were constructed.

Electro-motors may be divided into three classes:

1. Soft iron armatures alternately attracted by electro-magnets and *vice versa*.

2. Steel magnets attracted and repelled by electro-magnets and *vice versa*.

3. Electro-magnets attracted and repelled by electro-magnets.

Each of these three classes may be operated upon the principle of to-and-fro or reciprocating motion, having a crank connection, like the piston movement of the steam engine; or they may be operated upon the rotary principle, which appears to be the most advantageous in the application of electricity to power, especially when the Pacinotti ring principle is used, which has wrought a revolution, in motors as well as in dynamos.

In the discussion which followed the reading of the paper, Dr. Vander Weyde gave several illustrations on the blackboard of the various types of motors, pointing out their merits and defects. He showed that those of the first-class were the least efficient while those of the third-class are the most powerful, and that the principle is the one now generally applied in the electro-motor.

A point was also raised regarding the function of the projecting teeth in Pacinotti's armature. Mr. Pendleton showed that while they had a purpose in a motor their action was detrimental in the armature of a dynamo, and he referred to the abandonment of this form of armature by constructors of dynamos. Mr. Pendleton also explained and illustrated a motor of his own in which the armature, of the Siemens type, had three poles instead of the usual two, and was designed for a simple motor which should have no dead points.

* A paper read before the New York Electrical Society, Wednesday evening, May 12, 1886.

Reported Amalgamation of Canadian Telegraph Lines.

Inquiry being made at the Western Union office in this city regarding the rumors afloat in respect to "deals" in Canadian telegraph lines, it was said by a prominent officer that nothing was known of the reported amalgamation of the Canadian telegraph lines, and that if negotiations were in progress they had not reached a point where it was necessary to consult the Western Union Company, which controls the Great Northwestern and the Dominion telegraph companies. Erastus Wiman, president of the Great Northwestern, is in London, but will start on his return trip this week. A friend of his, who confessed that he was not fully acquainted with the details of the plan said that it had been proposed to unite the Canadian companies for the express purpose of preventing unnecessary competition and building. It was designed to let the Canadian Pacific Railway occupy the new territory opened by the completion of its road, and to confine the older companies in their present districts. By this arrangement the railroad would not be obliged to build new lines in a territory amply provided with telegraph facilities, and, on the other hand, the telegraph companies would avoid the results of costly competition, which they would have to meet by building in the newly opened country. Nothing had been accomplished in the way of an agreement, but there was a fair chance that the negotiations would be finally successful.

The Effect of Electric Currents on the Oscillations of Pendulums.*

BY N. KOLKIN.

Several years ago I noticed some peculiarities in the oscillations of suspended bodies. If an oscillation was produced in any direction, from any cause, I frequently found that there was a gradual change in direction, until one was reached which was kept with great tenacity. Sometimes there would be changes from oscillation to circulation, and *vice versa*, several times.

These peculiarities have been accounted for in an off-hand way; the causes assigned have been: Peculiarity of the original impetus given, obstacles on one side of the support, and currents and vortices of air. We may remove these causes, and still we find the same peculiarities.

For experiment, a hole may be bored in the lower side of any horizontal strip of wood that is raised a distance above the ground. A wooden plug, to be inserted in the hole, may be split in two, and the cord or fibre, which carries the suspended body, may be held tightly between the two halves of the plug.

If this pendulum is suspended between two vertical metal plates, respectively of zinc and copper, which are moistened by sulphuric acid, it will always oscillate in the direction of the electric current which passes through the air from the zinc to the copper. If the oscillation is at an angle with the current, the direction slowly changes. The pendulum should be entirely within the current to be observed.

Electric currents in the atmosphere are indicated in the same way. These, generally, have the same direction as the wind, commencing and ceasing an hour or so before it. It depends on the length of the pendulum, whether general or local currents are indicated. The Foucault pendulum indicates electric currents, and will not always turn the same way. The pendulum is always carried further in the direction in which the current moves.

In no case do we find that an electric current will effect the oscillations of suspended bodies, but will only change the oscillations. It will also magnify the effect of an impetus given to them, when the two forces act in the same direction; for a suspended body oscillates more easily in the direction of an electric current than in any other.

By means of minute pendulums it is possible to detect the smallest current, and they are the only means by which many mysteries in nature can be investigated. They have been used by me for several years both to test the accuracy of their indications and in physical research.

When a pendulum is made to oscillate in cloudy, damp, or very cold weather, the oscillations will never change from the original direction. It is only in fair weather that these experiments will have any satisfactory result. In such states of the weather, the pendulum will also come to rest sooner. The air may also be given the same condition as in foggy or cold weather by the friction of bodies; but the friction of bodies of different character, as wood and metal, will neutralize their effect. For these reasons, crowds of persons, or only one person, may easily spoil experiments of this kind.

If electricity be an ethereal fluid, that which gives the air the peculiarity spoken of seems to be an ethereal substance of another consistency; for the power to hold the pendulum may be imparted to the air over a well-defined region by the friction of substances, and an electric current may be found to pass through it, as it can be shown that it enters on one side and emerges from the other.

* A paper read before the Minnesota Academy of Natural Sciences, at Minneapolis.

Supporting the Commercial Cable Company.

At the meeting of the New York Board of Trade and Transportation on May 12, the subjoined resolutions were adopted:

Whereas, Through the competition of the Commercial Cable Company the charge for cable service to Europe was reduced from 50 cents to 40 cents per word, and the consolidated companies, with the manifest object of breaking down competition and subsequently increasing the price, lowered their rates to 12 cents per word, while the Commercial Company has lowered its rate to 25 cents per word, which is believed to be a fair rate, and has appealed to the commercial public to sustain them in the effort to establish an honest competition based on actual capital; therefore,

Resolved, In the opinion of this board the public should patronize the Commercial Company through which the

benefits of lower cable rates have been attained, and without which the public would undoubtedly have to pay, at least, double the rate established by the Commercial Company.

Resolved, That many of the evils under which our commercial and financial systems are now suffering may be attributed to stock-watering and other forms of financial juggling, and the business community owe it to themselves to sustain those corporate enterprises which are honestly capitalized and conducted.

The New Daft Motor and Limit Switch.

The success that Mr. Leo Daft has met with in the power stations on his system, now in operation in Boston and Worcester, Mass., has induced him to enter upon the manufacture of a more extended series of sizes and to remodel his machines to meet the requirements of more varied work.

The form which he now employs is shown in our engraving, Fig. 1. It will be seen that the field magnets are of the simple horse-shoe form, and that the armature is of the Gramme type, as in Mr. Daft's previous models.

The machine is designed to deliver normally six horse-power, but upon test it has been driven to as high as eleven horse-power without injurious effect.

Constant speed at all loads is naturally the first requisite in an electric motor designed for stationary power plants, and hence accurate regulation must be provided for. The present machine, according to Mr. Daft, maintains its speed within two per cent., between maximum load and no load. To obtain this result, the machine has its field wound compound with three different windings. Of these one is a "series" and the other two are shunts.

The coils are wound on spools which are slipped over the wrought-iron cores, and can readily be removed for examination when necessary. The principal data regarding the machine are as follows:

E. M. F. designed for	100 volts.
Resistance of armature	0.15 ohm.
" " series coil in field	.024 "
" " first shunt "	32.73 ohms.
" " second shunt "	7.30 ohms.
Power	6 h. p. nom.
Number of revolutions per minute	1,300
Weight	875 lbs.

It is evident that in a system of electric distribution where power is furnished and sold to various consumers,

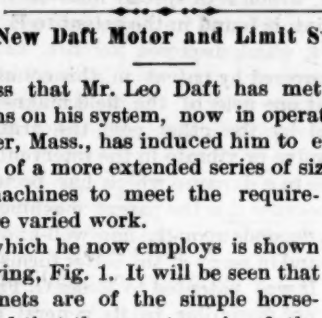


FIG. 3.

it is necessary to provide some means of controlling the maximum amount of power each customer may use, as well as to prevent injury to the machine by unskilled persons starting it with the full force of the current before the inertia of the armature is overcome and it has attained speed enough to develop a suitable working-resistance or counter-electromotive force.

Mr. Daft has provided for these necessities, and places upon the premises of each power consumer an apparatus designed for this purpose. It is shown in Fig. 2. Figs. 3 and 4 are details which are shown in outline in Fig. 2.

It will be seen that mounted on a shaft supported in journals is a gradually increasing cam *A* of insulating material, and this cam is rotated by a toothed wheel *B* on the same shaft, and a worm *C* meshing with the wheel and operated by a crank from the outside. Upon the periphery of the cam are arranged strips or sections *D D* of copper, and supported in standards and insulated from each other are two contact pieces *E E*, which bear upon the strips on the cam. At the highest part of the cam is placed a transverse conducting strip *M* insulated from the other strips and adapted to complete the circuit direct between the spring contacts. In the bottom of the box is a resistance coil *G* and a cut-out switch *F*, the armature *H* of which is adjusted by a regulating screw *I* to withstand the desired degree of attraction before moving and to retain the snap switch *J* in position.

An indicator *K*, is attached to the cam-shaft, which shows the relative position of the cam, so that the operator may properly manipulate the switch and know the position of the parts inside by the location of the indicator with reference to the words "off" and "on."

The circuits are traced as follows: Entering at the post *P* the current passes, by wire 1, to one of the spring contact pieces *E*, which, in its normal or "off" condition, rests upon the insulating material of the cam, and no current can pass. As the cam is slowly rotated the contact-brushes bear upon the conducting-strips, one of which is electrically connected to the frame, and thus by the wire 2 through the resistance-coil to wire 3 and out by post *N*. When both contact-pieces bear upon the cross-strip *M*, the current passes through the same and the contact-piece, by wire 4, through the cut-out and to post *N*, short-circuiting the resistance.

The operation of the apparatus will now be readily understood. Supposing the indicator to point to the word "off," the spring contacts will rest upon the smallest part of the cam, and as the strips on the periphery do not extend to this part, the contacts will rest upon the insulating material of the same and no current will pass. If, now, the handle is turned, the cam will be slowly rotated, bringing the conducting strips under the spring-contacts, and as these strips are connected to the resistance coil, the current will first flow through the coil, and the armature of the motor will not be endangered; and as it requires a number of turns of the worm to complete the rotation of the varying-cam, some little time will elapse after the first contact of the strips with the spring-contacts before they will reach the transverse conducting-strip, when the resistance will be cut out and the direct circuit be completed through the strip and spring-contacts, permitting the motor to have the full force of the current, and the indicator will point at "on." It will be seen that, during this operation, the armature of the motor will have attained considerable velocity, thus developing a suitable working-resistance to prevent injury to the brushes or other parts.

As stated before, there is a cut-out added, which prevents the use of more power than is contracted for. The coil of the cut-out is placed in the main circuit, and the

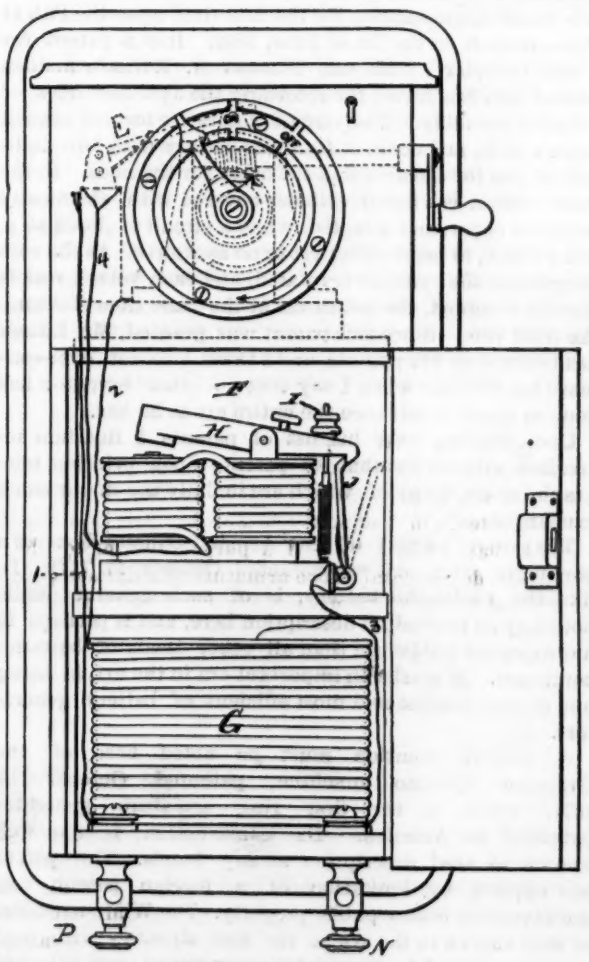


FIG. 2.—LIMIT SWITCH.

armature may be adjusted so as to allow a current of a certain specified strength to pass without operating it; but any abnormal increase due to overloading the motor or otherwise would cause it to be attracted toward the magnet core, thereby releasing the snap-switch and breaking the circuit. The adjusting screws permit of regulation for a wide range of current, and can be adjusted for any desired consumption of power. The cut-out box is kept locked and under the control of the parties at the central station, and the consumer is limited, therefore, to the use of the amount of power contracted for. In the event of an attempt to take more power than contracted for, the speed of the armature is reduced, the internal resistance of the machine being thereby decreased, the flow of the current will quickly reach the point at which the adjustable cut-out has been set, when the circuit is severed and the consumer is obliged to notify the company before the machinery can be placed in working order again. The use of the gradually increasing cam is also valuable in preventing the operation of the cut-out when the machine is started, as otherwise an abnormal flow of current is likely to occur which would operate the cut-out. It also furnishes a safe and effective stop-switch, for as soon as the increasing-cam in its rotation causes its highest part to pass the spring contacts, they will instantly fall upon the smallest insulated part of the cam, thus severing the circuit without the possibility of forming an arc for any appreciable time. If at any time there should be a sudden abnormal increase in the current in the line from any cause, the cut-out operates to prevent injury to the machine.

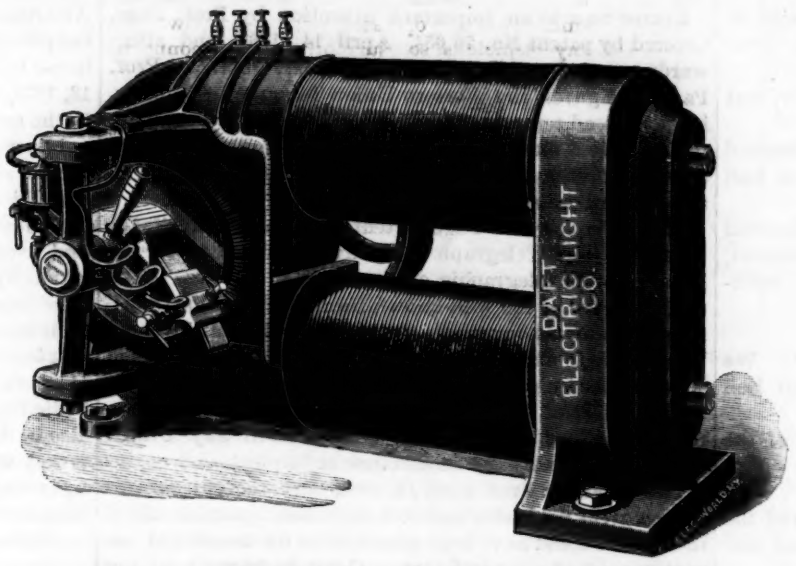


FIG. 1.—PERSPECTIVE OF NEW DAFT MOTOR.

The Change in the New York Electrical Society.

As announced by us some time ago, the New York Electrical Society has decided to unite with the American Institute, of which it will form the Electrical Section. This action, which was brought about through the labors of the President, Dr. P. H. Vander Weyde, is one which will without doubt place the society on a firm basis of usefulness and upon the road to prosperity.

The first meeting of the society at the American Institute Building was held on Wednesday, the 12th inst., in the large lecture hall, and after the transaction of routine business, which included a vote of thanks to the President for his kind offices in bringing about the coalition, Dr. Vander Weyde read an interesting paper on "Some Early Experiences with Electro-Motors."

While the meetings of the society will henceforth be held in the American Institute building, the formal admission will be delayed until the month of August, when the next meeting of the trustees of the American Institute

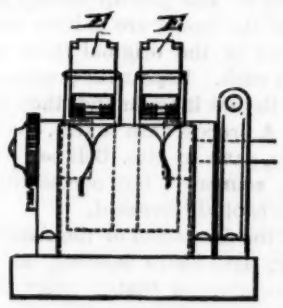


FIG. 4.

takes place. In the meantime the members will have full privileges at the Institute.

This change cannot be too highly commended, for it places at the disposal of the society a reading room, a library of 3,000 volumes, which is open until 10 every evening, and a fine lecture hall. While the dues are not increased for those who do not wish to join the American Institute as such, the latter society only requires that the president and secretary of the Electrical Section be members of the Institute; in all other respects the Section governs itself and controls its own treasury. The American Institute, however, may be depended upon for necessary funds to acquire much needed apparatus useful in lecture demonstration, it having but recently voted $500 to the Photographic Section for a like purpose.

Those who attended the first meeting of the society in its new quarters expressed their unqualified approval of the change, and we need only mention the fact that the lecture hall is capable of seating 300 persons to insure a large attendance at the next gathering.

"Ten Million in Ten Years."

This sensational headline has appeared in many daily papers, and under it the Associated Press report of Professor Bell's testimony before the Pan-Electric Investigating Committee, including the following:

Q. So that her (Mrs. Bell's) ten million interest has grown from the original one-third interest on this instrument from 1876 to 1880?

A. Yes.

This was printed as it stands by papers of all shades of opinion with remarkable unanimity, and, therefore, seemed hardly open to doubt, strange as it was. If Professor Bell himself valued his wife's interest at $10,000,000,

that settled the matter. But it appears, from inquiry, that no such question was asked and that no such answer was given. The point is worth clearing up, and it may be well, therefore, to consult the stenographer's official report of the hearing, a printed copy of which is before us. We make the following extract:

Q. Do you know how much stock your wife obtained in the National Bell Telephone Company in place of her interest in the Bell Telephone Company?

A. It was the equivalent of what she obtained in the other company.

Q. Well, can you state the amount?

A. No, sir, not of that company.

Q. Then you do not know what amount of stock your wife obtained in the American Bell Telephone Company?

A. It was again the equivalent of what she held in the preceding company.

Q. Can you state the number of shares?

A. No; I cannot even approximate.

Q. Had she disposed of any part of her interest prior to the organization of the American Bell Telephone Company?

A. I do not think she disposed of any portion prior, but I would not state with any positive certainty.

Q. If you are correct as to that, she must have obtained very nearly one-third of the capital of the American Bell Telephone Company?

A. No, sir. I do not think that, because she obtained her proportion of what she held in the original association, and money had been brought in extensively in the intermediate stages.

Q. Yes, I believe $200,000 had been added.

A. I do not know. You can calculate it probably. We can ascertain exactly by consulting the American Bell Company's stock list.

Q. But she must have been a very large holder of the Bell Company's stock?

A. I presume so.

Q. And whatever may have been her proportion of the original ten millions had grown from the original one-third of the value of these instruments?

A. Yes, sir.

Q. From 1876 until 1880 I believe was the date—sometime in 1880?

A. Yes, sir.

Q. Passing through two or three companies?

A. Yes, sir.

It will be seen that this is very different from the press reports, by which Prof. Bell is made to say that Mrs. Bell owned a ten million dollar interest in the American Bell Telephone Company, whose entire capital stock—though not the value of its whole assets—is represented by that figure. When three persons own a patent jointly and other parties come in and put up money to exploit it, if those who furnish the money are to have one-half the new stock, the holdings of the original three sink from one-third to one-sixth each. Repeat the process, and they sink to one-twelfth. Repeat it again and they dwindle to one-twenty-fourth. A process akin to this, the constant addition of fresh cash, gave to Mrs. Bell her "equivalent" in each succeeding company, but necessarily reduced her proportion as the capital increased.

At the time of the formation of the American Bell Telephone Company, Mrs. Bell's holding, as shown by the record in the Secretary of State's office in Boston, was $300,000. This is rather different from the $10,000,000 interest, concerning which so much has been said.

Carrier Pigeons and Telegraphs in War Time.

Some practical and very interesting experiments with pigeons as war messengers were carried on at Dover, England, in connection with the Easter manœuvres, the experiments being conducted within the cognizance of the Duke of Cambridge by Captain Allatt, of the Royal Military College, Sandhurst, who has been engaged for some time past in training pigeons for the purpose. The operations at Portsmouth and Dover were based upon the "general idea" that invading forces have landed on the southern coasts, and, being in possession of the country in the vicinity of Portsmouth and Dover, proceed to invest those places. The telegraph has fallen into the enemy's hands, and the English Garrisons are, therefore, unable to communicate by ordinary means with any other part of England. A number of messenger pigeons belonging to Dover have been trained to meet such a contingency, and are employed to maintain communications with the beleaguered garrisons. The birds were sent from Dover to Portsmouth, to London and to Canterbury, on the receipt of the news of the landing of the invaders at Whitstable Bay. By this means it is hoped that, in spite of the presence of the surrounding enemy, the besieged will not suffer from a complete severance of all their communications. The whole of the distant communications during the battle of Lydden were made by these interesting little travelers. On the Saturday morning two pigeons were liberated at Canterbury by the Secretary of the Pigeon Flying Club. The first bird reached Dover at 8 A. M., and conveyed the following message to the Deputy Assistant Adjutant-General: "The invaders have reached and occupied Canterbury in force, and taken prisoners all telegraph officers. It is believed the army intends to march on to Lydden at once with main body. Will send further information when I have obtained definite particulars from spies. Bird liberated at 7 A. M." The message was forwarded to the Assistant Adjutant-General before the force left Dover. Only an hour later another message was received, stating that the invaders were advancing on Lydden with a strong force of not fewer than 7,000 men with 8 20-pounder guns, and that the enemy's ships were believed to be still at Whitstable Bay. Thus the Dover troops were warned of the approach of the enemy, notwithstanding that telegraphic communication had been cut off, and were able to prepare for the attack of the invaders.

History of the Electrical Art in the United States Patent Office.*

BY C. J. KINTNER.

(*Concluded.*)

I come now to an important invention by Prof. Page, covered by patent No. 76,654, April 14, 1868, and afterwards reissued on the 10th of October, 1871, by Prof. Page's assignees, the Western Union Telegraph Company, in such broad terms as to include all telegraphic apparatus wherein a main circuit is caused to operate or control a local circuit, and also the use of a retractile spring to an armature of an electro-magnet.

This is the famous Page patent, so long held by the Western Union Telegraph Company as a menace over the heads of other telegraphic corporations.

It consisted of the well-known form of induction apparatus with an automatic circuit breaker, and was invented by Prof. Page many years before he took a patent, which was granted by virtue of a special act of Congress, he being an officer of the United States Patent Office, and therefore disqualified by law to take an interest in any United States patent except by inheritance or bequest.

This patent expired April 14, 1885, and thereby opened wide a great field, although it is extremely questionable if the reissue could have been sustained in its broadened aspect in view of modern Supreme Court decisions touching the question of broadened reissue patents.

We now note the appearance of the first double type wheel printing telegraph, patented to E. A. Calahan, April 21, 1868, and reissued to the Gold and Stock Telegraph Company on the 25th of July, 1870.

This instrument was the first to utilize double type-wheels, one of which printed letters and the other figures.

An interesting invention is found in a patent to two Frenchmen, Messrs. Chauvassaignes and Lambrigot, bearing date of July 28, 1868, wherein the message to be transmitted was marked in non-conducting ink upon a metallic tape designed to act as a transmitter by which the circuit of a telegraph line was broken and closed, and the message was recorded upon sensitized paper at the receiving station. Inasmuch as the rapid telegraph companies are using this invention as embodied in more improved apparatus to-day, this invention notes an early stage in an art then quite undeveloped.

I desire now to call your attention to an invention by one whose name appears for the first time upon the Patent Office records on the 1st of June, 1869. It is a patent for a vote recorder. This was Thomas A. Edison's maiden patent, and is a device for recording the ayes and noes of a voting assembly. Two circuit closers are located at each voter's desk, and connect from the battery with two indicators, one for the ayes and the other for the noes. In the same circuit is a metal cylinder covered with chemically prepared paper, and adapted, when a circuit is closed at a voter's desk, to print either aye or no as desired. As the vote progresses, the cylinder is rotated, and each voter's vote is silently recorded, the indicators at the same time checking the total vote. Since this patent was granted, Mr. Edison has taken over 150 patents, and I think I do not over-estimate his abilities when I say that no other inventor has done so much to advance the entire art as he has.

Upon looking over his list of patents I find him accredited with no less than 45 patents upon printing telegraphs alone, many of which are in daily use in our stock exchanges.

The gravity battery of Jean Armand Callaud deserves a passing mention, and was patented October 17, 1871. It, like the Leclanché battery, is of such general public notoriety as to need no description here, and is perhaps in more general public use than all other kinds of batteries combined. It marks an important era in the art, in being one of the cheapest and most efficient of battery generators.

A passing mention must be noted here of the Gramme dynamo machine, patented October 17 1871, which is the first ring armature generator patented in America. Its construction is too well known to need description at my hands. The patent has expired by limitation of a foreign patent, and the inventien is now public property. The Wilde machine, so well known in the art as the first dynamo with field magnets excited from an extraneous circuit, was patented in the year 1866, Nov. 13, and is now public property also.

We come now to an interesting invention in the patent of J. B. Stearns, 126,847, May 14, 1872, for overcoming statical disturbances on long duplex lines by the use of condensers. Prior to this invention it was not possible to transmit accurately two or more messages on existing duplexes over distances exceeding from thirty to fifty miles. Mr. Stearns conceived the idea of giving to the artificial line of a duplex telegraph an artificial electro-static capacity which should equal that of the main or direct line. This he did by inserting adjustable condensers in a branch of the artificial line, and adjusting them until no false signals occurred. This was the first great step in successful long-distance telegraphy.

An invention, which is of special interest from an historical standpoint, is found in the patent to E. W. Siemens, of April 14, 1874, which discloses the first unipolar magneto machine covered by patent in this country. It is so constructed that one pole of the field magnet lies within or is surrounded by the other pole, the armature being arranged to revolve or vibrate in the intervening field.

We now come to a dynamo which has peculiar interest at this time because it is the parent machine patented in America, which depends upon the now well-known reactionary principle found in many of the better forms of dynamos in use to-day. It was patented to Moses G. Farmer, April 13, 1875, and is not dissimilar in its general construction to the series wound reactionary dynamos now found in public use. Although Mr. Farmer obtained a broad claim for the reactionary principle, it has since been discovered that Hjorth, Pacinotti, Siemens and others had patented and described this applied principle in Europe as early as and even earlier than 1870, so that this patent merely stands upon the record as being the first to claim an applied principle, which has since received such general and wide-spread application.

It is a remarkable fact that by a strange chain of coincidences many of the leading and essential features embodied in successful incandescent and arc lighting and also in dynamo machines to-day are public property. It is only upon comparatively limited patents that existing light corporations are based, and this rightly by virtue of abandonment or public use on the part of the original inventors of these broad features.

The advent of the year 1876, the one hundredth anniversary of our national independence, seems to stand out in bold relief as a year of progress in the electrical art.

Prior to the first of January of this year, the Patent Office records note, all told, 1,923 patents.

On the 7th of March, 1876, a patent was issued to Alexander Graham Bell for a speaking telephone, which gave a new impetus to invention and at once gave to the world an increased idea of the importance to be attached to that wonderful, intangible element—electricity.

From that date to the present, I cannot undertake to consider as I have in the foregoing remarks what individual inventions have been realized, and cannot even hope to give you a faint idea of what is disclosed in the 8,000 patents granted in less than ten years—more than four times the number previously granted in a period of nearly a half century.

In 1877, came Brush with his well-known dynamo and his improvements upon arc lamps, followed by Weston, Hefner-Alteneck, Thomson and Houston, and a host of others, until the inventors become almost legion.

You are all, I doubt not, quite as familiar with the existing state of the art disclosed by well-known apparatus in general public use, as am I, since the apparatus in such general use is but a copy of that disclosed by the Patent Office. Telephony has grown from the parent patent of Bell to include more than 500 patents; arc lights as many more, and incandescent lights and fixtures a like number.

Whole new classes of invention have grown up in the period of less than ten years, until as they multiply we are forced to ask when and where will this march of genius cease.

I cannot close my remarks without saying something of the unwritten history of this wonderful art in the Patent Office, a history known only to the employés of the office, and oftentimes intensely interesting.

This unwritten history embraces many inventions of great practical utility which lie buried in secrecy for reasons known only to their authors; they tell oftentimes the sad story of want, privation and suffering, and sleep for years only to be resurrected after some more fortunate independent inventor has succeeded in reaching the desired goal.

There is very much of interest and importance in this secret history, and were the records of abandoned cases made public, as in my opinion they should be, the art would receive much that is valuable which will now remain a sealed book forever.

In conclusion, I beg to call attention to the very important position which the Patent Office records hold in the written history of the art and to the fact that our patent system is the best which the civilized world ever knew.

We stand to-day at the head of the civilized world as being the one nation noted for its great inventions. Our ingenuity as a nation of inventors is far-famed. It is due not alone to a peculiarly ingenious people, but rather to the fact that the humblest citizen realizes that for a mere pittance he can patent and secure from his government a monoply of his invention for a limited time.

The system has stimulated inventive genius wherever it offers itself, and to-day we find ourselves a nation of educated people whose homes are surrounded with all the comforts which civilization can give us.

* Abstract of a lecture delivered before the Franklin Institute.

Some Recent Advances in Telephony.*

BY THOMAS D. LOCKWOOD.

Ten years ago a meeting of the American Academy of Arts and Sciences was held in Boston, at which Alexander Graham Bell expounded his ideas upon the electric speaking telephone.

Prior to that date a patent had been issued to the same gentleman upon the same subject; a patent which many persons state they have since ascertained refers in no way whatever to the speaking telephone; a statement which many other persons, perhaps equally well informed, believe to be based upon a wish that such were the case.

The first line built between two distant points expressly for telephonic transmission, was completed April 4, 1877, and extended from the office of the electrical manufacturer, Mr. Chas. Williams, Jr., 109 Court street, Boston, to his house in Somerville, a distance of about three miles.

May 1, 1877, the first lease of telephones for private line service was effected; and in May, 1877, telephones were first operated upon the exchange plan through a switchboard in the office of Mr. E. T. Holmes, 342 Washington street, Boston; the sub-stations comprising a number of different offices connected with the Holmes' burglar alarm system by wires converging to Mr. Holmes' office. For a number of years it was assumed that the exclusive field of usefulness for the telephone, like that of the average and proverbial specimen of charity, not only began, but also ended at home; that the local short line, or exchange service, was the only kind in which telephones could, or would be, practically used. Recent experience proves this assumption as hardly correct. The exchange, or central office service, it is true, is the more immediately practical and obvious utilization, and it was natural that the American people should measurably fill that sphere of action before looking for others, inasmuch as that was the line of operation promising the most speedy pecuniary return for the outlay. Lines of from a few yards to a dozen miles in length have, however, been connected with exchanges, and these have in turn been supplemented, as occasion served, by what are technically termed extra-territorial lines—that is, lines connecting different exchange centres; and from 1879 to the present time it has been a regular practice to talk over such lines with comparative ease perhaps for an average distance of 40 or 50 miles. In some of the Western States it has been a common thing to converse by telephone over much greater distances by switching lines together, but not always with ease.

I think it well understood now that three conditions have conspired to retard what is at present termed long-distance telephony. These are:

(*a*) The uncertainty of obtaining satisfactory and speedy reciprocal communication, and the consequent slowness of transmission, together with the inevitable result of such uncertainty, namely, the low prospective maximum capacity of remunerative transmission.

(*b*) The extreme noisiness of long lines, and increased telephonic induction, or cross talk, which in many cases renders the single or earth terminal circuit insufficient.

(*c*) The lack of transmitting instruments sufficiently powerful and trustworthy to develop voice currents capable of overriding the undesired currents and the noises produced thereby, and of sufficient E. M. F. and volume to affect the distant receiver with clearness and strength.

If it be asked at the present time, "What is long-line telephony?" I answer: "Telephonic communication over lines more than 50 and less than 500 miles long." Six years ago I should have limited it to lines between 20 and 50 miles long, and six years hereafter I may possibly fix the limits of long-line telephony between 250 and 1,500 miles. The term is purely comparative.

The most noteworthy advance of the telephone in the past few years has been in the direction of increasing the distance over which communication can be transmitted satisfactorily, and the advance which has been made is, I think, undoubtedly attributable to the introduction of copper line wire, and to the radical improvement of the transmitting telephone.

It must not be supposed that telephone communication over long lines was until recently entirely unknown, even when we accept the above definition of a long line.

On the contrary, it is a well authenticated fact that in the earliest days of the speaking telephone, time and space were well nigh obliterated.

In the remote period when the magneto speaking telephone was the only known—and was itself a new and wonderful thing—it was operated over lines of (for that time) really considerable length. On Aug. 11, 1876, for example, conversation was carried on at Brantford, Canada, between Brantford and Mount Pleasant, over five miles off, and on the succeeding day the length of line was increased to ten miles.

As early as November 10, 1876, a very long line was successfully used. I find among the early records of telephony the following statement: "November 10, 1876. We carried on a long conversation on the lines of the Eastern railroad using part of the time a circuit from Boston to Salem (15 miles) and part of the time a circuit from Boston to North Conway and back to Salem, and from Boston to Portland and back, about 200 miles of actual wire."

This statement is made by Mr. Watson (who like De Sauty was long supposed to be a supposititious character, being always at the other end of the line) and is noticed in the Boston *Post*, *Globe*, *Advertiser* and *Herald* of November 27, 1876.

In the early spring of 1877, with a box and magneto telephone, Mr. Bell, in New York, conversed with his associate in Boston on a Sunday, and he speaks of the occasion in the following words:

"The longest length of real telephone line through which I have attempted to converse has been about 250 miles.

"On this occasion no difficulty was experienced so long as parallel lines were not in operation. Sunday was chosen as the day on which it was probable other circuits would be at rest. Conversation was carried on between myself, in New York, and Mr. Thos. A. Watson, in Boston, until the opening of business upon the other wires. When this happened, the vocal sounds were very much diminished, but still audible.

"It seemed indeed like talking in a storm. Conversation though possible could be carried on with difficulty."

There are in fact a number of such isolated cases and I have thought proper to refer to these as showing that the idea at least is old, and that the magneto telephone is not an utterly incapable instrument, even viewed as a transmitter. There is, however, a wide gulf between an occasional successful experiment, made under favorable conditions, in which experts can understand one another, and regular every day successful commercial communication.

FIG. 1.—LONG DISTANCE TELEPHONE LINES.

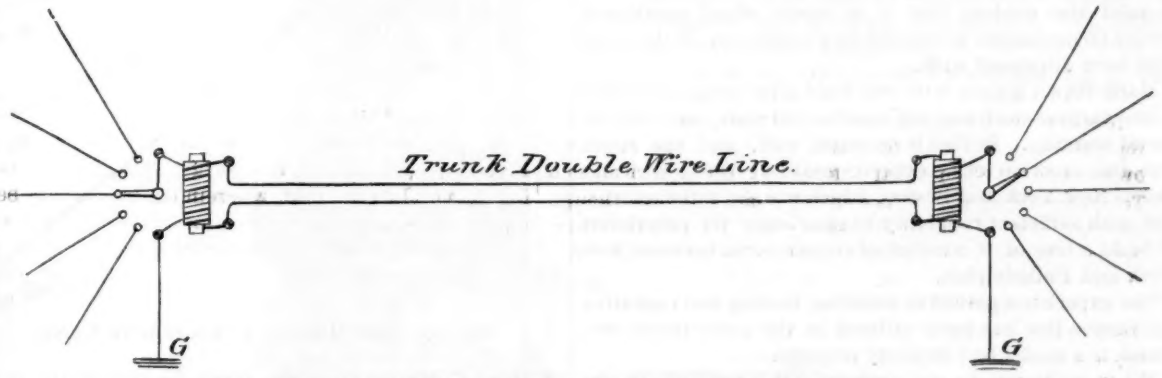


FIG. 3.—LONG DISTANCE TELEPHONE LINES.

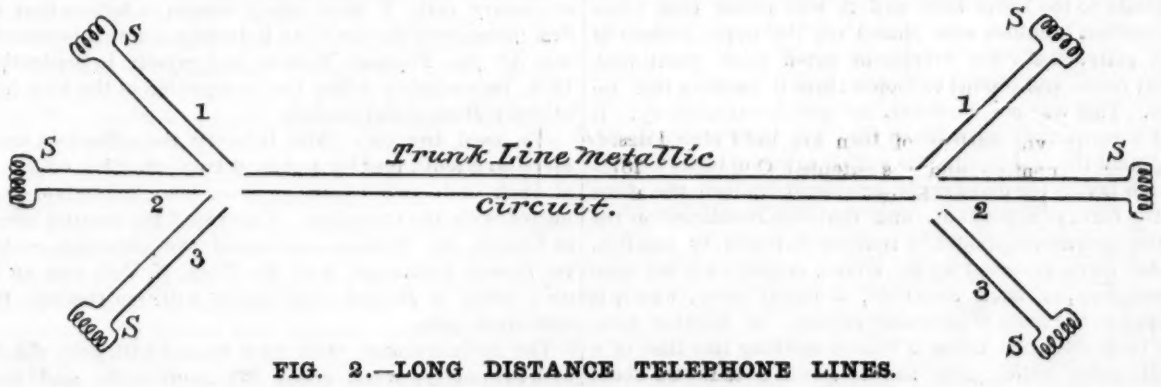


FIG. 2.—LONG DISTANCE TELEPHONE LINES.

If by recent developments this gulf has not been permanently and solidly bridged, there has at least been a convenient and useful ferry established.

Before leaving the early years of the telephone, it may amuse, if it does not instruct, to refer to an item which appeared in the *Scientific American* on November 29, 1879, entitled "How far can we hear with the telephone?"

"This is a question frequently asked, but one which we believe has not yet been definitely settled. The longest distance that we have seen mentioned is given in the item below, namely, two thousand miles. But perhaps Mr. Edison has had more extended experiences. If so, we should be glad if he would let our readers know. An exchange states that Mr. Robert A. Packer, superintendent of the Pennsylvania Railroad, is at present hunting with a party of gentlemen in Nebraska. A few days ago he for two hours conversed pleasantly with his wife and friends at Sayre, Pa., his brother at Mauch Chunk, Pa., and his friends along the line. The medium was the railroad and Western Union Telegraph wires, and Edison's telephone. At the office in Bethlehem, Pa., connection was made with the Easton and Amboy wire, and at Perth Amboy with a Western Union wire and thence to Chicago and North Bend, Neb., where the party are. The distance was about two thousand miles and every whisper was audible."

Now if there is anything in the world that annoys one it is to hear an apparently trustworthy account of something being done in one's own special line of work which, with every appliance for the purpose, with experience and special education, we cannot do ourselves. It is not therefore speaking too strongly when I say that this statement both mystified and exasperated me, for I knew certainly that at that time I could not accomplish such a feat; but I possessed my soul in such patience as I could make available and awaited developments, having at least a suspicion that there might be an error in fact, seeing that the veracious chronicler had already committed himself to the statement that Mr. Packer's business relations were with the Pennsylvania Railroad instead of the New York & Pennsylvania Canal and Railroad Co., as it should have been. I had not long to wait, however. In the issue of Dec. 27, 1879, a second item appeared entitled "Long Range Telephoning" (I thing the original one should have been called "Long Range Reporting") which read as follows:

"In a recent issue of this paper an exchange was credited with the statement that Mr. Robert Packer, while traveling in Nebraska, had conversed with his wife and friends at his home in Sayre, Pa., two thousand miles distant, by means of a telephone. We now learn on good authority, that though Mr. Packer's friends received his communication by telephone it was not so sent by Mr. Packer. The message was sent from Nebraska to Mauch Chunk, Pa., by telegraph; thence it was telegraphed to the Sayre office of the Pennsylvania Canal & Railroad Co. (of which Mr. Packer is superintendent) and from there it was transmitted to Mr. Packer's house by telephone, falling short of the newspaper report of the telephone's performance by some nineteen hundred and ninety-nine miles and a fraction."

Such is a sample of the long-range telephony of 1879.

When in the summer of 1879 a telephone line of two wires was built between Boston and Lowell it was regarded as a great achievement; for it worked well. It, however, opened our eyes to the phenomenon of induction in ancther phase to that in which it had heretofore been made manifest, that phase in fact which in more recent times has beennamed "cross-talk."

We found that when conversation was transmitted upon either wire, it would be heard equally well upon the other at the receiving station, and until many other lines were built, it was found practically impossible to operate both lines at once.

This was the beginning of lines to connect distant telephone exchanges and the seed from which sprouted the long-line telephony of to-day. When, however, the value of copper as a material for line wire was recognized, the commercial feasibility of long-line telephony, as above defined, became a subject of serious consideration, and exchanges located 75, 100 and 150 miles apart, were brought into conversational proximity.

The possibilities of the telephone were never brought before my mind in so striking a manner as when I stood in a little room on Broadway in this city, and talked with a

* Read before the American Institute of Electrical Engineers, May 19, 1886.

fellow mortal in Cleveland, Ohio. Many of the members of this Institute will doubtless remember that when the compound wire of the Postal Telegraph Co. was built and communication over it completed in 1883, first to Cleveland, and later to Chicago, a noble army of telephonic patentees hastened to try their patented telephonic receivers and transmitters over it, and how each and all, after successfully exchanging words with the Western cities, went forth proclaiming to the world the unparalleled excellence of their special form of telephone.

When I first heard these statements I was firmly convinced that the achievements described were due not to any special excellence of the instruments employed, but to the greatly superior conductivity and insulation of the Postal wire over any other that had heretofore existed, and my conviction was intensified after I had had an opportunity to make the test myself and had found that not only could we make a Blake transmitter transmit speech which was perfectly reproduced at the receiving station, but that identical results could likewise be achieved with the magneto Bell telephone commonly used as a receiver.

To Mr. Thomas B. Doolittle, of Bridgeport, is due the credit of having first discerned the merits of copper as a material for telephone lines. A line of hard-drawn copper was erected by that gentleman in November, 1877, in Ansonia, Conn., a section of which was taken down in August, 1884, and found to be, when compared with any iron wire of like age, in an excellent condition. I may also say that from the first moment of my acquaintance with Mr. Doolittle, I have found him a strong and persevering advocate of copper wire for telephone lines, and, considering our present views upon the relative merits of iron and copper, it is fair to say that I think he has made out his case and was considerably ahead of the times. My own fear was that it would prove too soft for common use, would not stand up, would expand under increase of temperature, and would fail to duly contract upon the resumption of normal temperatures. I had no doubt of its electrical merits.

The Postal wire, however, was electrically so far ahead of all expectation, telephonically considered, that it seemed to prove, once for all, that copper, if mechanically available, was decidedly the proper material to use, and it seemed also evident that if it would stand up alone it would be even more successful as a conductor, if the steel core were dispensed with.

Hard-drawn copper wire was tried after being submitted to the various electrical and mechanical tests, and was not found wanting. In fact it promised well, and the result was the erection of an experimental line of two wires between New York and Boston, which worked satisfactorily, and with sufficient reliability to encourage its proprietors to build a line of a number of copper wires between New York and Philadelphia.

The experience gained in building, testing and operating the Boston line has been utilized in the more recent one, which is a model line in many respects.

When we began to use copper for this purpose, it was not easy to account for the comparative ease with which a line built of that material could be operated. It was attributed by many solely to the low specific resistance of copper, and I recollect instances where I have commented upon this remarkable point, and have been met with the remark, "Oh, it is only a question of resistance." But it was obvious that there was some more deep seated reason than the low specific resistance; for, if we take two lines of equal resistance, one built of copper and the other of iron, the copper is invariably by far the easier one to work.

This was, I confess, for a long time a problem to me, but has recently been wonderfully cleared up by the masterly researches of Professor David E. Hughes, as detailed in his inaugural address, lately delivered before the Society of Telegraph Engineers and Electricians; with which every electrician interested in the communication of intelligence should familiarize himself.

His experiments showed that the E. M. F. of the extra current, in a solid iron wire is much greater than in a similar copper wire; that ordinary copper wire has, with rapid currents, more than three times the resistance during actual work than that supposed to be its resistance (although with stranded iron and ordinary copper such is not the case), and that the extra current in wires furnished with a parallel return wire is much reduced; but much more in copper than in iron, viz., iron 15 per cent. and in copper 80 per cent.

It is also interesting to learn that the E. M. F. of the extra current in brass wire, compared with copper, is but as 13 to 20. This point may prove useful when a wire, stronger than copper, but of equal size, is at any time required.

These researches are so interesting and valuable that they gratify me nearly as much as though I myself had made them. I am aware that the statements of Professor Hughes have been severely criticised by Professor Weber and others, as was to be expected, but I am persuaded that his results will, in the main, be ultimately approved, and his views acquiesced in by the world of science; although it is very probable that some errors of detail may be found in them.

Approaching now advances made in instruments, I may say that it is noteworthy that nearly every improvement has been made in the transmitter. There are two good reasons for this. The first being that the receiving telephone came into existence well nigh as sensitive and perfect an instrument as it was possible to make it; and the second that in view of the noises, made apparent in the receiver on long lines, due to undesired currents, it was manifest that the transmitting power it was that required intensifying, to the end that it might be able to develop currents of sufficient strength to override the disturbing currents, and that if a transmitter of sufficient power could be made, it was even possible to reduce the sensitiveness of the receiver, and thus weaken the distributing noises by thickening the diaphragm, or by removing it to a greater distance from the magnet. The form of transmitter which has been found most successful is one in which granulated carbon in a loose and free state is employed as the current regulator. When first introduced it consisted simply of a handle, having a disc-shaped cavity cut in its face, the bottom of the cavity being faced with some suitable metal or alloy as copper, silver or brass.

The front of the chamber was closed by a piece of platinum foil, which served as a vibrating diaphragm, and the sides of the chamber were formed of the same non conducting material as the body of the handle itself. The space between the back and front plates was partly filled with the carbon granulations, and the front plate protected by a mouth-piece. The instrument was then complete, and, though exceedingly simple in construction, worked, and worked well. When in use, it was most efficient when held so that the diaphragm presented an angle

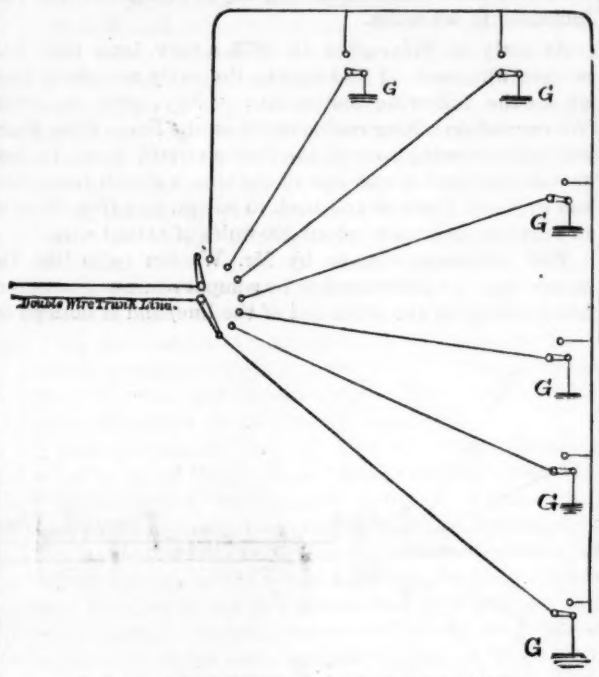


FIG. 4.—LONG DISTANCE TELEPHONE LINES.

of about 45 degrees from the vertical position, the upper edge being inclined backward.

When this instrument was good, it was "very, very good," and like the little girl of the nursery rhyme, when it was bad, it was "horrid."

It had one grave fault, the granulating powder would occasionally pack itself into a mass, and was then anything but as sensitive as it should be; under such circumstances it became a very poor transmitter. The customary remedy for this disease may be indicated by the familiar words of counsel, invariably found upon the apothecary's label, "When taken, to be well shaken," and, when shaken, the sick transmitter would usually resume its duties. But an ounce of prophylactic is better than a pound of medicine, and the want was decidedly a transmitter equal to the Hunnings, but which would not pack.

The first step was the adoption of a horizontally mounted diaphragm, the speaking tube of which ended opposite to the lower face, and it was found that when the carbon granules were placed on the upper surface of this plate, the voice vibrations acted upon them with great force, and tended to loosen them if packing had begun. This was not, however, completely satisfactory. It was subsequently ascertained that the back plate should, to obtain the best results, lie buried in the mass of carbon which lay on the diaphragm, or should dip into the same in the form of a pendant, and that the resistance of the entire instrument should be reduced as much as possible.

One form, invented by Mr. Blake, employs for the complimentary, or back electrode, a metal sieve, which is buried in the mass of granular carbon. In another form the back electrode takes a form something like that of a shade roller pulley, and has a number of holes bored through it in different directions, so that the carbon granulations can freely circulate. In both cases it is found advantageous to plate the electrode with some unoxidizable metal, such as gold, and to form the diaphragm, as in the original Hunnings' instrument, of platinum foil.

One of the circuit wires is united to the diaphragm, the other to the back electrode, and the mass of granulated carbon lies upon the former with the whole or a portion of the latter immersed, or buried in it. These transmitters give admirable results. The tone, volume of sound, and clearness of articulation developed by them is most encouraging, and by their use the range of long distance telephony has already greatly expanded even on long, single iron wires. The distance that they can be efficiently operated has not even yet been authoritatively ascertained, but, judging from the fact that instruments of the most inferior character can be made to maintain successful conversation between New York and Chicago over a compound wire, we are encouraged to believe that conversation can be easily transmitted over much greater distances than that by availing ourselves of the most improved forms of Hunnings' telephone. It is well-known that long telephone lines are greatly troubled by the noises manifested in the receiver; these noises being due to magnetic or current induction, leakage from other wires, atmospheric and earth currents, and magneto-electric currents induced in them when they are blown about, and thus made to move across the magnetic lines of force of the earth.

It has been found necessary, in order to reduce these disturbances to a minimum, to adopt an old laboratory expedient, and to provide each line with a wire return as nearly as practicable equidistant with the direct wire from all known sources of disturbance, so that the disturbing currents, proceeding in the same direction on both sides of the circuit, will neutralize one another. But when we take such a double wire, we find that it is not easy to preserve its benefits, and at the same time to connect it with a short exchange line at both ends, for, if we take a parallel wire metallic circuit trunk line and connect it with a short subscriber's single wire line by absolute contact, as in Fig. 1, it is obvious that we have lost the basis of neutralization, and only gained a conductor of lower resistance.

There is two plans from which we may choose. We may run a double wire to each subscriber wishing to use the long line facilities, as in Fig. 2, in which case the problem is at once solved; for, when we unite the two terminals of the subscriber's short loop line with the two wires of the long trunk line, we have simply extended the said trunk line half a mile or a mile, or whatever distance it may be, further.

This plan, however, presents some disadvantages, in that it necessitates a double wire for each subscriber's line, and the concomitant changes in apparatus at the central station; and it is, after all, rather an inordinate expense to incur, when the subscriber may possibly only use the long line once a month.

The alternative plan is to employ repeating translating coils. These are really induction coils of peculiar construction, the two circuits of which are made much nearer each other in the size of wire and resistance than is usual in the ordinary coil.

One of these circuits—that which is composed of the finest wire, and which is wound to the highest resistance—is connected in circuit with the two ends of the long metallic circuit trunk line, while the remaining coil has one terminal, united to the single central station end of the subscriber's line, and the other attached to a ground wire. This arrangement is shown in Fig. 3, in which one terminal of the local side of the coil is represented as being united with a button switch by which it may be connected with any desired subscriber's line. The beneficial results of the neutralization of the disturbing currents are thus obtained, these being at least minimized by means of the return wire; while the telephonic currents induce currents of like character in the coil which is in circuit with the shorter and local line, thereby reproducing the transmitted speech in the receiving telephones connected therewith.

The reason for making the two circuits of these translating coils so much more nearly equal in character and conductivity than are those of the ordinary induction coil, is that each is in turn the inducing and induced circuit—that is, the conversation is transmitted from the long trunk line to the short subscriber's line, as well as from the short line to the long metallic circuit. Each is, therefore, required to exercise the functions of both primary and secondary coil. I have every reason to believe that the first instance of the use of an induction coil in this capacity was by Mr. Thomas Watson and myself, in September, 1879, immediately after the completion of the two lines between Boston and Lowell.

We used the two lines between the cities as a trunk metallic circuit, and by means of two induction coils, one at each end, two exchange lines were inductively connected with the main line. I operated the ground circuit at Lowell, Mr. Watson engineered the induction coil at the Boston Exchange, and Mr. Theo. N. Vail was at his own office in Boston, and talked with me through two induction coils.

The coils we then used were wound with both circuits approximately equal, about 250 ohms each, and were wound together from beginning to end, two wires being wound on the spool at the same time, a mode of construction which, by the way, experience has, I think, demonstrated to be the most satisfactory for inductoria intended for this purpose, and which will probably be adopted.

It is proper to note that we were led to this idea by considering the mode of using the transmitter induction coil, which was even then well known; this use, however, though analogous is not identical, for it must be remembererd that in the transmitter coil the iron core is maintained during action in a state of magnetic polarization by the battery currents, whereas the currents, traversing the surrounding circuits of the translating coil, have not suffi-

cient strength to effect such a state in the core, and the induction of these coils is, therefore, almost entirely current induction of one of the coil wires upon the other, the magnetic reactions between coil and core being necessarily trifling in character. The induced effects may, however, be intensified by separately magnetizing the core, either by a separate battery coil or by a permanent magnet, and I have sometimes done this with advantage.

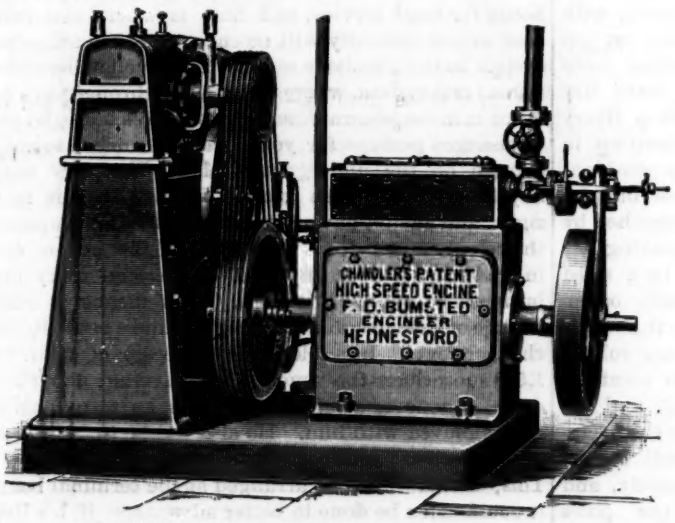
A third plan whereby the double line may be conveniently connected with any one of a number of short grounded lines, without depriving it of any of its virtue, has been patented by Mr. Geo. H. Bliss.

This is indicated in the diagram, Fig. 4. It consists in extending from the central station an additional line wire which may branch into as many sub-stations as are intended to use the long double wire trunk line. Each of these sub-stations may be fitted with a button switch which, when turned in one direction, will retain the telephones in their ordinary ground circuit, but which, when turned reversely, will disconnect the subscriber's line from its ordinary earth terminal and unite it with the branch from this extra circuit, thus providing a double, although not a parallel, wire between the central and sub-station, both ends of which may be then united with the two ends of the metallic circuit trunk line.

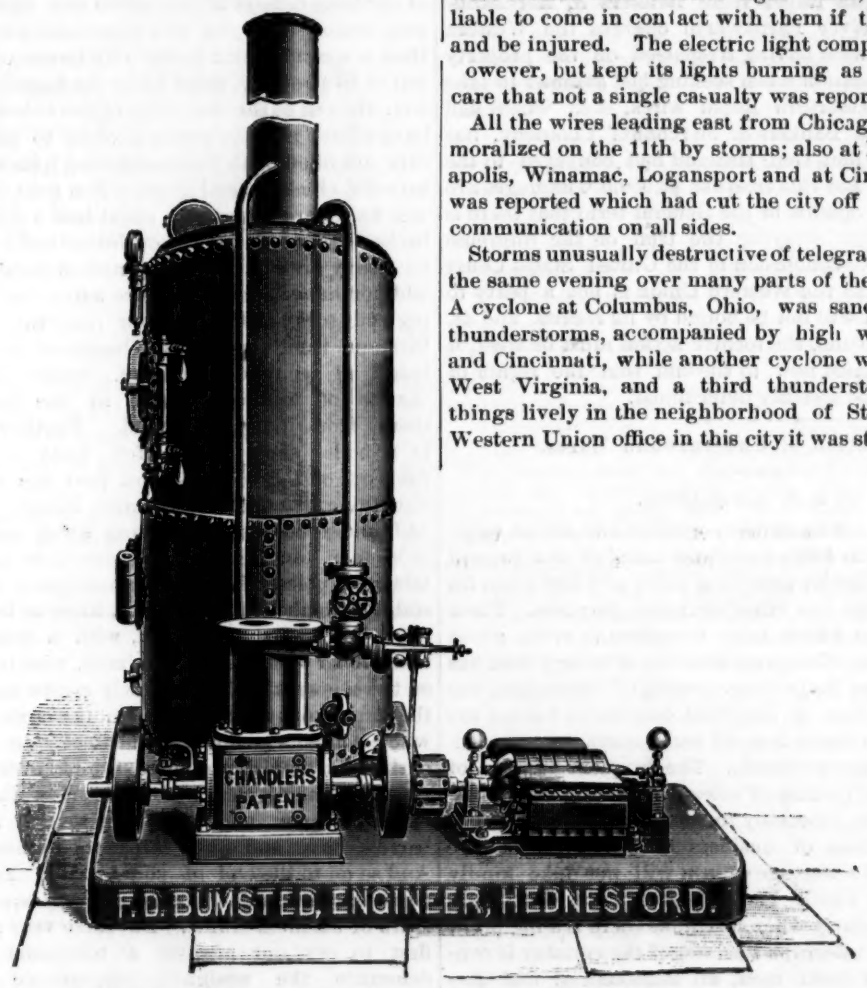
One extra wire of somewhat abnormal length is thus enabled to serve in place of a great number. It would be easy to fit the telephone call boxes with a double gravity switch and two separate telephone receivers, one on each side of the bell box, and to so connect these switches with the circuits that it might be invariably understood that when the receiving telephone on one side is taken from its place and used, the line would be used in its normal condition, but that the other telephone, when taken up, would connect itself and the transmitter in the loop circuit. One could then be always used for short line and the other for long-line work. I am very favorably impressed with this, and do not believe that it has yet had the trial it deserves.

I am conscious that this paper already is too long. I may not, therefore, on this occasion describe at length the specialties in switching and signaling appliances which have been found necessary, and have consequently developed in the practice of long-line telephony, but hope either to say or listen to something of this branch at some future time.

I have, I think, said enough to prove that long-line telephony is a reality, the New York *Times* on contract obligations to the contrary notwithstanding.



COMBINED ENGINE AND DYNAMO.



ENGINE AND DYNAMO, DIRECT-CONNECTED.

English Engines for Dynamo Running.

It is noticeable that English engine builders, like their American brethren, are beginning to construct engines with a special view to their use in electric lighting plants. This fact was conspicuously brought out at the recent Inventions Exhibition in London, and it is said that it will be again exemplified at the Colonial Exhibition. We have already illustrated several of the English engines of most familiar make, and now show another that embodies some very good features.

It is a neat and pretty little engine of high-speed class made by Mr. Bumstead, of Cannock Chase Foundry, Staffordshire, and was used for driving 30 lights of a Patterson & Cooper Phœnix machine. In this engine, which is made under Chandler's patent, special attention has been given to the question of lubrication at high speeds, and the accompanying engravings will show the method of retaining the lubricant inside the engine. For this purpose the bed plate or box is divided by a partition, on one side of which are the crank shaft, connecting rods, etc., and the rapid movement of these parts splashes the oil up into all the working parts of the engine. Plates perforated with small holes, entirely prevent the undue mixing of the oil and water, and effectually retain the oil floating inside the crank chamber. A small hole allows water only to pass out into the exhaust box, and there is also another small hole which allows the water, when it has reached a certain height in the exhaust box, to flow over into the exhaust pipe. Thus a constant level of water is kept in the crank chamber, with a thin film of oil on the surface, which is dipped into by the big end of the connecting rod every stroke. No sight-feed lubricator is used, but simply an ordinary oil cup, which is filled about every 12 hours and merely measures a definite quantity of oil into the chamber. The governor of this engine has also a special arrangement for lubricating it, by means of a little basin formed on the governor casting which catches the condensed water as it leaks from the valve spindle and serves to float a little oil on the surface so as to bring it in contact with the working parts, the superfluous water being drained from the basin by means of a little overflow pipe. Altogether, the arrangements for oiling are very good, the oil being used over and over again till it is regularly spent; and when the engine stops, the use of the oil stops of its own accord. Unlike those engines in which the steam is greased, in this the lubricant does not pass off with exhaust vapor. In the arrangement shown at the exhibition the dynamo was fixed on a table bolted down to the same bed plate as the engine. This brought the machine to a very convenient height for adjusting the brushes, cleaning the armature, etc.—a point of very considerable practical convenience. Half the break-downs and troubles with dynamo machines arise from the fact that to get at the armature or set the brushes one has to lie flat on the floor, and the consequence is that the attendant often lets the machine run dirty or the commutator burns itself away. The elevation of the machine lends itself very conveniently to the application of the two-to-one rope driving gear, which transmits action from the crank shaft. There are four grooves, both in the large wheel and in the pulley, and an endless cotton rope passes round them all, being led over a tightening pulley adjustable on a vertical standard at the back. This arrangement was the joint invention of the late Professor Fleeming Jenkin, Professor J. A. Ewing and Mr. Chandler. It certainly, in this instance, works very smoothly, and the whole machinery runs so silently that many passed it by without noticing that it was in motion. During the latter part of the exhibition another of these engines was placed in the machinery shed and put to work, as shown, to drive a Siemens dynamo for charging the Electric Power Storage Company's batteries in the East Arcade. The machine was coupled direct to the crank shaft of the engine, and both ran at 950 revolutions per minute, but the smaller sizes are constructed to run up to 1,200 revolutions per minute for driving fans, etc. Where compounding is applied to these engines, the high pressure is placed tandem to the low, and in this form they are made to indicate up to 65 h. p., with 80 lbs. steam pressure

Hours of Labor.—In a talk with Mr. Chas. A. Brown, manager of the Western Electric Company, says the Chicago *Industrial World*, the following facts were gleaned: Before the 1st of May the employés of the company held meetings and appointed a committee to discuss the situation. The company met the committee, and no demand or request was made, but the situation was discussed. It was agreed as an experiment that the works should run 56 hours a week in place of 59. The men are contented with this arrangement. If the company find it impracticable to run on this basis other arrangements will be made. Three hundred men are at work, and no changes have been made.

Wires Destroyed by Storm.

Reports from all parts of the country show that the wires suffered very seriously from the heavy storms of last week. In the West, where cyclones wrought general havoc and devastation, there was in some parts a complete cessation of service for a while. At Kansas City the destruction was wholesale. The tornado of the 11th made fearful havoc of the telegraph and telephone wires, both in the city and surrounding country. All the wires were reported down immediately after the storm, with the exception of one to St. Louis. This virtually shut off telegraphic communication with both East and West. The Western Union office was besieged all the afternoon by an anxious crowd who were desirous of wiring their friends in the East that they were safe. The Western Union found it necessary to post a notice to the effect that no messages could be received, except subject to a long delay, communication with New York being carried on by way of Dallas, Tex. Finally all messages were refused.

The Western Union then sent out a large force of linemen, pressing all available hands into the service for the purpose of repairing the wires, but the wires were not all in working order before the end of the week.

The telephone company suffered considerably by grounded wires and broken poles, but was in good shape inside of two days. The management asked the electric light officials not to run their lights that night, as his wires were crossed with electric light wires, and people were liable to come in contact with them if they were lighted, and be injured. The electric light company did not stop, owever, but kept its lights burning as usual, with such care that not a single casualty was reported.

All the wires leading east from Chicago were badly demoralized on the 11th by storms; also at Lafayette, Indianapolis, Winamac, Logansport and at Cincinnati a cyclone was reported which had cut the city off from telegraphic communication on all sides.

Storms unusually destructive of telegraph wires prevailed the same evening over many parts of the west and south. A cyclone at Columbus, Ohio, was sandwiched between thunderstorms, accompanied by high winds, at Chicago and Cincinnati, while another cyclone was sweeping over West Virginia, and a third thunderstorm was making things lively in the neighborhood of St. Louis. At the Western Union office in this city it was stated that between 7:30 and 8 o'clock the wires to New Orleans and the Southwest had begun to give way. About 9 o'clock the St. Louis wires went down, and a little later the Cincinnati wires followed suit. Communication with Cincinnati over one wire by a roundabout way was afterward reopened, and like communication was re-established with New Orleans. One wire remained between Chicago and St. Louis. These, however, were entirely inadequate to the demands of the press business.

Inventing Plays as Well as Telephones.

The remarkable disclosures in the Pan-Electric scandal have aroused much curiosity as to the Rogers family, to which the whole affair owes its origin and development. A great deal of fun has been poked at the elder Rogers, by the way, for his pretensions as a poet, but the half that he has done in that direction has probably never seen the light. A friend who once lived near the Rogers family in Georgetown and had to pass their door every morning and evening on his way to and from his office in the city, says that he used to hear the most violent cries and shouts proceeding from the domicile. At first these sounds used to frighten him, and each day he would glance through his newspaper as soon as he got it, to see whether any of the family had committed or suffered murder. Not only was he disappointed in this search, however, but whenever he saw two of the Rogerses, the poet and the telephone inventor, together in public, they seemed to be on the most friendly terms. He could not understand it. One day he played eavesdropper, and heard a deep, male voice cry: "I tell thee, thou shalt die!" and the piteous treble of a girl responded: "Oh, spare me! spare me!" This was too much. In an agony of dread he communicated his

discovery to a friend who knew the whole tribe, and who received his confidence with a peal of laughter that made the very rafters ring. Then it came out that Papa Rogers was the author of a drama entitled, "Madame Surratt; or, the Lost Cause." He had assigned a part to each member of the household, and insisted on frequent rehearsals. Everybody, old or young, who ate at a table and slept in a bed in the Rogers dwelling was a partaker in the daily performance, even down to the colored maid-of-all-work. As fast as a new little toddler appeared on the scene a part would be written into the play for its benefit, for the head of the family was as prolific in providing dramatic expedients as in the domain of paternity. This wonderful drama has never seen print.

The Two Million Dollar Damage Suit.

It appears likely that the suit against the Western Union Company for $2,000,000 will soon get a hearing. The General Term of the Supreme Court of New York, on May 18, affirmed the decision of Judge Andrews rendered at Chambers, refusing to stay the trial of the suit of J. G. Farnsworth, as Receiver of the Bankers & Merchants' Telegraph Company, against the Western Union Telegraph Company until after the determination of the suit now pending in the United States Circuit Court by Gen. Edward Harland, as Receiver of the American Rapid Telegraph Company against Receiver Farnsworth, for the separation of American Rapid from Bankers & Merchants' wires, etc. Receiver Farnsworth charges the Western Union Company with having trespassed on the property in his lawful possession when seeking last summer to take into its custody American Rapid wires, etc., which had been leased to the Bankers & Merchants' Company, but the right to use which Gen. Harland had conveyed to the Western Union. For this trespass $2,000,000 damages are sought. It is the opinion of the General term that there is no good reason for delaying the trial of the Supreme Court suit until the conclusion of the United States Court action, inasmuch as the Western Union is not a party to the latter suit and will not be bound by its results, and as, whatever those results, the former action must be tried, it might as well be tried now, to the end that the rights of the plaintiff may be speedily determined.

The Question of Underground Wires.

BY D. B. MACQUARRIE.

A great deal of unreasonable prejudice and unjust opposition exist in the average American mind of the present day against the aerial system of poles and line wires for telegraph, telephone and other electrical purposes. There are several causes which have conspired to bring about this state of affairs. The great amount of money that has been made by a few individuals owning or controlling the stock and franchises of electrical companies has led the general public to believe that all such companies are earning and paying large dividends. The frequent number of consolidations and pooling of interests between rival companies of late years, especially in the telegraph service, has given to this class of business an air of exclusive monopoly, and the average citizen will not take kindly to anything in which he himself is not financially interested, particularly when he thinks there is a big profit in it. The whole telegraph business of the country is controlled by about a dozen men, all millionaires, and this cry of monopoly is only the natural outcome of the difference between the successful and unsuccessful financier; between the middleman of small means and the wholesale dealer in securities; between labor and capital. Whenever and wherever a man has by his skill, perseverance or integrity amassed a large fortune he invariably incurs the enmity and jealousy of those less fortunate or successful. The present heroic measures that are being put forth against what is termed the "telephone monopoly" are only another illustration of this phase of human nature.

All electrical companies, as well as other similar incorporated organizations, are chartered by the different State legislatures, and a permit is given them by the different city councils within their territory or field of operations. These charters and permits are often in the nature of rights and concessions, which the public claim should not be granted, or which should secure to them reciprocal privileges and advantages. Hence a natural spirit of opposition to such companies.

Another and a just cause of complaint is the careless manner in which poles and wires are put up and maintained in even the largest and most populous cities of the country. When a company has once gained a foot-hold in a large city and built the foundation part of its system, all its energies thereafter seem to be concentrated on paying dividends. This is praiseworthy as far as it goes, but it should never be done at the expense of poor work and cheap construction and bad maintenance service. The poles should be selected for quality and straightness. They should be carefully planted, and kept perpendicular by guying when necessary. They should be given two coats of paint when first put up, and an additional coat at least every two years. No advertisements or signs should be allowed to be fastened to them, and the butts to the height of six feet should be served with wire or hoop iron to prevent horses from gnawing them and the inevitable whittler from disfiguring them. The wire should be strung tight and uniform, and protected by guards wherever it leaves the pole or crosses the street.

The third cause for unpopularity is the alleged danger to life and property by a too close proximity of the line wires. No matter how convincingly the electrician may deliver his lecture or how eloquently the lightning-rod man will recite his memorized little speech, there is a deep-rooted conviction in the mind of the masses that a number of wires electrically charged in close proximity to a house will convey the lightning thereto. This feeling has been increased and intensified by the introduction of the electric-light system. There is actual danger in a contact with these wires whenever the current is turned on. The daily papers have chronicled from time to time the death of employés and fires in buildings caused by the intensity of the current on these wires, and people are naturally afraid of them, and want them banished with other dangerous elements of society to the underground regions.

The objection to a line of poles on a business street as being unsightly is, I think, rather overdrawn. A telegraph or telephone line carefully built and properly maintained is more of an ornament than a nuisance to any business street. It gives it an air of prosperity, and is not any more unsightly or objectionable than a thousand other appliances and machinery which enter into the daily routine of legitimate traffic. Take a walk through the busiest streets of our large centres of commerce any day during the shipping season and you will encounter something like this: Here is a commission house with boxes of eggs and crates full of live poultry piled up to the height of ten or twelve feet, and out to the very edge of the sidewalk, so that you have to step into the gutter in order to pass it, while your ears are filled with the maddening quacks of imprisoned turkeys, chickens and geese. You next come to a wholesale hardware house with about half a dozen heavy drays backed square against the curbstone and loading or unloading heavy freight. A keg of nails will roll up towards you and you have to cut the figure 8 lively to prevent it mashing your toes. Three or four men will be passing long bars of iron from a sub-basement to a wagon, and laugh at your discomfiture, while you watch your chance of finding a break in the bars as they pass them from hand to hand. Further on you come to a boiler shop, which, for want of room, spreads itself out on the sidewalk and into the very street, with something like one hundred men inside, outside, on top and under boilers, hammering away and making more noise than ten thousand woodpeckers up so many dry telegraph poles. Perhaps the next place will be a livery stable with about fifty buggies, more or less, drawn up in front, and a played-out Jehu, with a sort of a combination rubber costume, hose in hand, washing these buggies on the sidewalk. You narrowly escape being drenched by the spray from a burst part in the hose, or having the whole contents go down the back of your neck by a twist of the Jehu's wrist, and next stumble over a heavy oaken plank extending clear across the sidewalk from the doorstep to a wagon, and on which several men are rolling barrels, boxes and other things too numerous to mention. And so on to the end of your walk. You will find the streets and sidewalks blocked at every square by the necessities of business traffic. But these very men will be the first to cry out against a telephone monopoly, and denounce the unsightly appearance of the poles and wires on such a *fashionable boulevard*. And why? Simply because they want all the room for themselves, and are not willing that any other company should have even the small space necessarily taken up by one pole in a hundred and fifty feet. There are large business firms who keep the sidewalk in front of their store crowded from January 1 to December 31 with empty dry goods cases, barrels, and other rubbish, who would be the first to sign a remonstrance against the erection of a line of telephone poles on their particular street. The worst opposition the writer remembers to have received from any one person against planting poles opposite his premises was from the owner of a desiccating factory, the perfume from which smelled to the very heavens, and contaminated the atmosphere for miles around. People who will sneer at the unsightliness of a telegraph post for no other reason than because it is opposite their premises, will daily look on a veranda that has not seen any paint for two generations, or a ragged canvas awning fluttering in a breeze like a prairie schooner after a cyclone; and yet these people will descant in glowing terms of æsthetic tastes and the eternal fitness of things!

The remedy for all the ills and evils of so many poles and wires in the street is believed by its advocates to be the underground system. This, as far as our country is concerned, is still in its infancy, and there are not wanting those who believe it should always remain so. Electricians are not yet agreed as to its feasibility, and whether it can be adapted to our rapid system of telegraphy and intricate telephone service. The principal objections to it are urged under four different heads. These are electrical, mechanical, sanitary and financial.

The electrical difficulties which present themselves at the very threshold of the service are retardation and induction.

By retardation is meant a reduction of the speed that can be gotten out of the wires when buried in the ground instead of being strung on poles. It seems that a wire placed under the ground for any long distance, no matter how insulated, will not transmit electrical signals with the same speed as aërial wires, and this slowing-up factor increases with the length of the underground circuit. The reason given for this is that a sort of electrical sympathy exists between the conducting wire and the earth, with which it is surrounded on all sides, and which in itself is the largest conductor we can have. On a pole line this is never noticed, or, if it actually exists, is so very small as not to be appreciable. This may be illustrated by the working of ocean cables, which are somewhat similar to the underground system. The speed of the Atlantic cables varies from ten to eighteen words per minute, whereas a good aërial system will give from thirty to forty, according to the skill and speed of the operator.

The other electrical phenomenon which interferes with the successful working of an underground system is known as induction. The most familiar phrase that will express to the uninitiated the meaning of induction is, "cross-talk between the wires." Whenever two or more wires in close proximity run parallel for any long distance, the signals sent over one wire will be readily noticed on the other. This occurs in all circuits, aërial and underground, wherever delicate instruments are used and accurate service is required. Induction is the greatest drawback to the successful working of long-distance telephoning. Its influence is such that it is almost impossible to work two wires on the same set of poles to any greater distance than a few miles. Even in the common cables used for exchange connections it occurs to so great a degree that a magneto bell connected at one end of the cable will ring with the wire open at the distant end. This phenomenon, so prevalent and troublesome, even on aërial circuits, is greatly increased in the underground system.

The second objection urged against an underground plant is of a mechanical nature. The wires must be buried underneath the ground at a sufficient depth to insure safety and protection. This makes it impossible to get at them for examination or repairs except at stated places where provision is made for this purpose by manholes or some other mechanical device. All new wires added, or old, useless wires taken out must be worked slowly and carefully through these manholes. There is not as yet a clearly-defined system anywhere in use for distributing wires from the main cable and bringing them out to each house for local service, and here is where the principal mechanical difficulty will be encountered in adapting this system to the telephone service. I can well understand that a short city system, where the wires are brought to a central office as in the telegraph service, and have not to be touched or changed perhaps for years, can be worked successfully enough on the underground plan. The very nature of anything buried in the ground implies that it is out of sight, and should have a long rest. This is impossible in the telephone service. Two-thirds of the people engaged in trade do not own any real estate, and carry on their business in rented premises. This means a continual change of base, according as they can find a better location or cheaper rents. In a telephone exchange of from 1,000 to 1,500 subscribers the "moves" will average about four per day. Whenever a subscriber moves he wants his instruments moved with him. He also wants to retain his old and advertised number, even when put on a new wire. This, of course, can be arranged at the terminal board, but it could often be done to better advantage if his line wire could be carried a block farther ahead, or cut off a block nearer the office.

The next objection to the underground system is urged by sanitary experts. The subsoil under a large city becomes so impregnated with different gases and ingredients consequent upon bad sewers and surface absorption that it is as well not to stir it any more than what is absolutely necessary. It is claimed that chills and fevers are caused by the miasmatic exhalations from low, swampy lands in their natural state. If this be the case, how much more noxious must be the effluvia from an open ditch through a large city, where dirt and garbage have been absorbed by the ground perhaps for centuries! It is also claimed that foul air often gets into the conduits protecting the wires, and causes explosions. Two or three instances of this nature have already happened.

The last and most powerful argument against an extensive use of the underground system is its great first cost. This is admitted to be from four to ten times as great as the same distance of aërial wires. The public are already clamoring for reduced telephone rates, and have brought the subject into the courts for adjudication, and yet, by their unreasonable demand for an underground service, they are taking the very step which must necessarily increase instead of diminish the rates. A telephone company cannot carry on its business at a loss any more than a butcher or a baker.

If it be admitted that the underground system is both practicable and desirable, the next consideration is how it should be done and what are the devices hitherto used and now contemplated for its construction. From its earliest inception the underground system has been carried on through the ordinary armor-covered cables. The conductor is a copper wire, but more often a number of fine copper wires twisted together to form a single strand. The insulation is gutta-percha, with alternate layers of hemp and other insulating material. The pro-

tection has been at first the common wire armor used for submarine service, but of late years lead pipe is taking the place of the wire armor in all places where no danger is to be apprehended from abrasion. In Europe, where the underground system mostly prevails, the cable is buried direct in a trench some three feet deep, or in a wooden box filled with insulating compound, or in a metal or earthenware pipe. In the larger cities advantage is taken of sewers and tunnels, and the cables are fastened to the sides of these. The underground subways of Paris and the extensive railroad tunnels of London are examples of this kind. The present tendency in this country is toward a combination of both the cable and conduit systems. The wires are made into cables for convenience and insulation, and drawn through conduits for distribution and protection. In this connection it might be stated that a good cable does not need a conduit, and a successful conduit will do away with the use of the cable.

Reckenzaun's Mining Locomotive.

Mr. Reckenzaun has recently applied electricity to the haulage of coal in the Trafalgar collieries of Drybrook, Gloucestershire, and some recent tests made with the motor are of considerable interest, as they show a remarkable uniformity of action under various loads, together with a high efficiency. The motor is nominally of 4 h. p., and the resistances of its armature and field magnets are 0.2 ohm and 0.16 ohm respectively. The weight of the motor is 402 lbs.

Electrical energy was supplied to the motor fro m a number of E. P. S. storage cells, and the mechanical work was ascertained by means of a balanced Prony brake. The following table gives the results of the test:

No. of test.	Revolutions per minute.	Electrical measurements.		Prony brake		Electrical energy.	Mechanical work.	Percentage of return.
		Volts.	Current in ampères.	Length of lever in feet.	Weight on scale in lbs.	Horse-power $\frac{E \times C}{746}$	Horse-power measured.	
1	1020	105	35.5	2.625	7	4.98	3.568	71.65
2	1013	107	40.0	"	8	5.73	4.027	70.50
3	982	104.75	39.5	"	8	5.55	3.930	70.8
4	860	95.5	43.25	"	9	5.53	3.870	70.0
5	970	106.5	43.0	"	9	6.14	4.385	71.4
6	900	101.78	46.75	"	10	6.38	4.500	70.5
7	1022	113.6	47.0	"	10	7.15	4.110	71.4
8	1048	114.88	47.75	"	10	7.35	5.240	71.3
9	1047	121.88	53.0	"	12	8.66	6.282	72.5
10	1070	122.64	54.0	"	12	8.87	6.420	72.3
11	950	113.87	62.0	"	14	9.46	6.650	70.3
12	1040	127.7	72.0	"	17	12.32	8.85	71.8

In the motor tested there are only two brushes used (one pair), which were not shifted or adjusted during the tests. The motor is so designed that the brushes remain fixed in position, and the direction of rotation of the armature is controlled by merely reversing the direction of the current.

Electricity has for some time been successfully applied in these mines for pumping water and for ventilating, and it is now intended to supplant the horses used in the haulage of the coal.

Leatheroid Insulation.

One of the latest insulating materials introduced to public notice is "leatheroid." This substance is said to be a perfect insulator and non-conductor, and it has withstood electrical tests so satisfactorily as to result in its adoption by the Edison and other companies. It is made in sheets in all sizes and thicknesses, from that of paper up; and it is also made as tubing to any diameter. It can be cut, sawn, punched or drilled in any manner without danger of cracking or breaking, as it is not brittle but has a toughness resembling that of horn, and is susceptible of a fine polish. It consists of fibre reduced to a pulp and subjected to powerful chemical treatment. It is insoluble in all ordinary solvents, and is uninjured by alcohol, ether, ammonia, turpentine, naphtha, petroleum, or any other oil. Being so tough, it will withstand a very severe strain; and it will retain its elasticity under all temperatures, improving, it is stated, by seasoning. Another good feature is that it will receive a fine screw thread. The uses for such a material are numerous. Thus, it can be applied to dynamos, commutators, lamps, switches, switch-boards, telegraph instrument bases, backs of call boxes, telephone cases, batteries, magnet heads, plugs, wall insulators, push buttons, electric gas lighting appliances, electric fire and burglar alarms and all other apparatus of like nature. It can also be used for journal bearings and bushings, gibs for engine cross heads, etc. Its weight, bulk for bulk, is said to be less than any other like insulating material similarly employed, while its cost compares not less favorably. There are three colors in which it is made —black, red and gray. Having the many merits above indicated, "leatheroid" should be in brisk demand in all departments of electricity.

Cut-Out for Incandescent Lighting on Arc Circuits.

The long-distance systems of incandescent lighting in vogue have brought into use various devices for preserving at a uniform illumination the remaining lamps of a group in case of the breaking of one or more lamps. In series-multiple lighting the devices employed have hitherto in most cases been assembled at some place in a wall box, the external circuits and wires to each lamp being led to this box. In multiple-series lighting the breaking of a lamp has, by extinguishing the remaining lamps of a group, in some cases, acted as a safety-device. But the extinguishing of all the lamps of a group when the break occurs has often proved

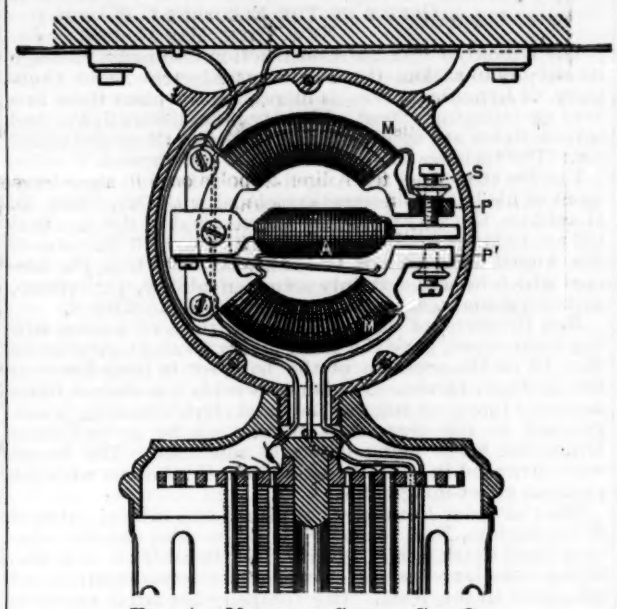


FIG. 1.—MULTIPLE-SERIES CUT-OUT.

a serious obstacle to the introduction of the multiple-series system in small installations.

Messrs. F. P. Little and William H. McDonald, of Albany, N. Y., have lately invented a device in which the difficulties met with in the two systems are so avoided by making an individual cut-out which is attached directly to the holder of each lamp, and which substitutes a resistance equal to that of the lamp when burning, as soon as the lamp is broken. This does away with the necessity of returning the lamp wires to any wall centrally, and saves a good deal of wiring. In multiple-series the failure of

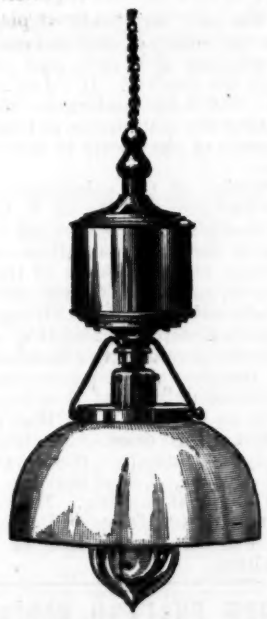


FIG. 2.—MULTIPLE-SERIES CUT-OUT.

one lamp causes a scarcely perceptible wink in the other lamps of the group and the brilliancy of the remaining lamps is unchanged.

The cut-out device, as shown in the engraving, Fig. 1, is a ring magnet $M\,M'$, with armature A vibrating between the poles P and P'. A spring maintains a contact between the armature and an insulated contact screw S when the lamp is broken or turned off. The circuit wire connects with the frame of the ring-magnet, and is connected with the rheostat through the contact screw S and coil M. The pole P and armature A are of opposite polarity when a current passes through the rheostat only. One end of the armature coil connects with the armature frame, the other end with the magnet coil M', the other end of the coil M' leading to the lamp. When the lamp is turned on, the coils A and M' cause the armature pole to reverse its polarity, and a repulsion is set up between P and the armature. At the same time the armature and pole P' become the poles of the coils A and M', and a strong attraction is set up between them. The armature overcomes the spring and flies away from the contact screw S, breaking the current through the resistance and establishing the lamp in circuit.

The rheostat consists of a pair of cross-frames through which are placed ranges of metal pins covered with asbestos, on which the bare German-silver resistance wire is wound, the whole forming a sort of compound reel. This form of winding allows plenty of space for the circulation of air. The case is of perforated brass, 3¼ inches in diameter by 3¼ inches in height. The cut-out is made either with or without a turn-off. Our illustration Fig. 2 shows the cut-out attached to the lamp.

The Pan-Electric Inquiry.

The Pan-Electric investigation committee resumed its work on May 11. Mr. A. B. Briesen, of New York, attorney of the National Improved Telephone Company, testified that Attorney-General Garland told him that he could not bring suit against the Bell Company himself on account of his interest in the Pan-Electric, but that Mr. Goode could.

E. N. Hill testified concerning the preparation of articles exposing the Pan-Electric. It was confirmatory of what has already been published. In the article written by Mr. Hill he alleged that Mr. Garland had attended the conference between Casey Young and his associates who wanted the government suit brought. Mr. Hill was asked to give the source of his information, but declined to do so, and the committee will decide whether to report him for contempt.

Mr. Oates laid before the committee the following letter addressed to the chairman of the committee by Mr. J. M. Forbes, of Boston:

BOSTON, May 6.

I find in the Boston *Journal* of this instant a dispatch which says that Mr. George Jones, of the New York *Times*, in his examination before the committee, makes the following statement: "Mr. Forbes had written to me that his son was a large owner in the Bell Telephone Company, and wanted me to write to the President of the United States to interfere in behalf of his patent." Upon examining a copy of the letter referred to, I find that this testimony does not fairly represent its purpose or object, which doubtless was owing to the unfortunate loss of the letter. To correct the mistake in the shortest way seems to be to send you another copy, which you may deem it best to lay before the committee. Perhaps after Mr. Jones reads it once more he may find it a pity that he did not follow its suggestions. Respectfully, J. M. FORBES.

The letter inclosed by Mr. Forbes is as follows:

BOSTON, Jan. —, 1886.

MY DEAR MR. JONES: By reason of my son's connection with the American Bell Telephone Company I have become acquainted with some of the facts in connection with the Pan-Electric Telephone Company's efforts to have Attorney-General Garland authorize suits to be brought for vacating the Bell patents. I learn from the managers of the Bell Company that they feel no anxiety as to the final results of any action taken by the government in this matter, though admitting that much temporary annoyance will result, should Garland acquiesce in the request of his company. Looking at it from a wholly different point of view —that of the independent voter—and in fact all who support and desire to support Mr. Cleveland, it seems to me the Administration would make a serious mistake if Garland's department is permitted to lend any countenance to the scheme proposed by the company in which he is so largely interested.

There is no doubt that all the matters contained in the claim, which it is proposed that the United States should set up, have been held and decided in the Circuit Courts of the United States, and these cases are well advanced for hearing on appeal to the Supreme Court. There is no doubt that the new move was made simply in the hope of obtaining indefinite delay in the suits for injunction against the Pan-Electric Company, already ripe for hearing before the Court at Baltimore, on the ground that no such suits should be heard while the government suit was awaiting a hearing. There is equally no doubt that the attempt is being made by a syndicate of Southern brigadiers to use the influence of a Democratic Administration in the interest of an enterprise of, to say the least, a highly speculative character, and to throw the weight of the government's power in the scale to test in the courts a suit in which this Southern syndicate is interested.

There can be no doubt that Garland received an enormous bonus of stock of the Pan-Electric Company for the influence he was expected to exert. The entire Republican press of the country will be only too glad to open on such a trail as this, but it seems to me of much importance that no such opportunity should be afforded them. Even were the procedure not a most unusual one, and had the claim not already been acted upon, and were strong presumptive evidence in favor of the claims proposed to be set up, the fact that the government interference is invoked in behalf of an enterprise of prominent Southerners and that a member of Mr. Cleveland's Cabinet is counsel for and one of the largest stockholders in the company interested, ought to show the extreme danger of permitting this thing to go a single step further.

I could give you confidentially the whole history of this claim, which would make the basis of a dime novel and be pretty good reading, but you already know the substantial facts of the case. If the Southern syndicate succeeds it will be a great step toward a new set of swindles such as you exposed in the Tweed case, and will, of course, be the end of Cleveland's usefulness—who cannot escape the blame of indorsing what his Attorney-General does. If you agree with me about this I shall be glad if you can see your way clear either by writing to some one who has Mr. Cleveland's ear, or possibly to Mr. Cleveland himself, or by using the power of your paper in such way as to aid in preventing the President from permitting such a dangerous step as the one proposed to be taken.

I am very truly yours, J. M. FORBES.

After the letters had been put in the committee discussed for some time the contumacious conduct of the witness Hill, and it was resolved to secure answers from him if there were any power in Congress to enforce them.

When the Telephonic Investigating Committee met on May 17 Manager Marean, of the Western Union at Washington, was placed upon the stand and requested to produce certain telegrams sent and received by Mr. Young and other gentlemen connected with the Pan-Electric and National Telephone companies. The witness declined to

comply with the demand, for the reason that the subpœna was in the nature of a drag-net or search warrant; that it did not specifically describe any particular messages, but sought to discover whether any messages had been sent or received by certain parties. Witness remarked that the scandalous use made of messages produced by order of the Congressional Committee in 1877 ought to satisfy this committee that no such demand should be made. The committee requested witness to produce the rule of his company and the instructions he had received from his superior officers. This he did later, producing the rule forbidding the delivery of messages except under certain conditions, and the committee discussed the question as to whether the subpœna served on the witness fell within the inhibition of the rule. Finally it was resolved to consider the subject in secret session and the witness was excused pending a decision on the question as to whether the committee should insist on its demand for the telegrams.

Mr. Van Benthuysen wanted to produce evidence bearing on the testimony given by Messrs. Sypher, Hill, Clark, Dana, Crawford, Reid and Pulitzer. He considered their evidence unreliable, and wished to contradict it. He also wished to show that the Bell Company had been in a conspiracy and used improper means to compass its objects. The committee considered Mr. Van Benthuysen in contempt already, and would decide whether to admit the written statement which he had with him. He was desirous of being represented by counsel. He was allowed to read his statement next day.

Note on the Relative Working Values of Battery Materials.

To the Editor of The Electrical World:

SIR: Undoubtedly battery men will have read with much interest the paper on "The Relative Working Values of Battery Materials," by Mr. Fitch, which appeared in the May 8 issue of THE ELECTRICAL WORLD, and yet one cannot but feel sure that the statements therein made will mislead those unfamiliar with the subject.

If I read the paper aright, the theory is advanced that a battery material is desirable or undesirable in proportion to its per cent. of "available oxygen or chlorine," but slight mention being made of several other factors which enter very largely into the use of chemicals for battery purposes. One of these factors is the question of price, which was slightly touched upon editorially (p. 209, same issue).

Very few men now-a-days question the relative electrical efficiency of two chemicals pound for pound, but *dollar for dollar*. According to Mr. Fitch's tables, it is demonstrated that a pound of chloride of silver can do 1.738 (or about 1¾) times the work of a pound of blue vitriol. Very true; but from the same data I can demonstrate that a dollar's worth of blue vitriol can do the work of one hundred and twenty-five dollars worth ($125) of chloride of silver. Tables showing the relative value of quite a number of battery chemicals, according to price, were long ago published in French by Niaudet, of Paris. So far as I know they have never been translated into English.

Nor does the practical battery man wholly rely upon the first cost of the materials used. As every one familiar with the subject knows, one of the great items of expense in running batteries, especially where large numbers of them are used, is the labor required to take care of and keep them in order. It is no exaggeration to state that in several forms of batteries very widely used at present, the labor of attending to them costs as much as, if not more than, the chemicals actually consumed in the battery; the greatest time being required, not for setting them up, but in cleaning them after they have been exhausted, and in getting them ready to be used again. Here comes in one of the great advantages of the use of bichromate of soda over bichromate of potash, for not only has it a higher electrical efficiency, pound for pound, and not only can you buy more of it for a dollar, but you can make several pounds of it occupy (in a battery solution) the space of one pound of bichromate of potash, and when the battery is exhausted the labor required to clean it up is much less than with bichromate of potash.

In view of the above-named reasons, and many more which are perhaps not so prominent, the theoretical chemical efficiency of battery materials seems to fall into the background, as, after all, perhaps not the most important thing to consider.

Let me not be misunderstood. The above is not intended as, and must not be construed into, a criticism on the "chlorine battery," with which the writer is unfamiliar, nor as a sneer at the value of atomic weights in the hands of the battery man. No electrician can afford to be ignorant of those methods of calculation which will enable him to determine theoretically in what proportion chemicals combine, and should be used. The article above referred to gives a most excellent example of the value of accurate knowledge of this kind, but if the atomic weights assigned to some of the elements therein named were slightly changed they would better conform to the best authorities, and the calculations would be of more value to electrical literature.

Objection can also be raised to the statement that in battery solutions made from bichromate of soda and bichromate of potash, the base with which the chromic acid is combined, before the addition of sulphuric acid, is of no consequence. Neither can it be demonstrated that the acid would work better in the absence of the sodao r potash. The soda or potash is certainly found in the exhausted battery, not as the sulphate, but in the form of an alum. One might as well say that in a Daniell cell the sulphuric acid was not combined in the blue vitriol solution, or sulphate of copper, but as free sulphuric acid in the presence of oxide of copper, and that it was quite immaterial whether it was the oxide of copper or some other metal.

ALLAN V. GARRATT.

BOSTON, Mass.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, May 17, 1886.

The Brooklyn Electric Construction Company, through its sub-organization, the Piedmont Electric Light Company, of Lynchburg, Va., is increasing the plant there to a very encouraging extent. The city takes 136 arc lights, and several lights are used by the merchants. More are called for. The turbines in use give perfect satisfaction.

I notice that Mr. Fred Angell issues formal announcement of his having become associated with Mr. Clark B. Hotchkiss, the agent for Day's kerite, and of the fact that his headquarters will be at the new offices, 16 Dey street. Mr. Angell has a host of friends, who wish him the success which he will certainly secure if ability, experience, grit and genial manners have anything to do with it.

Noll Brothers, of 65 Fifth avenue, the well-known wiring contractors, gave the hotel men a pleasant surprise on May 12, on the occasion of the banquet in their honor at the Hoffman House. The banquet table was shaped like a diamond facet—to suggest the hotel clerk's favorite jewelry—and in the centre was floral work lit up by Edison lamps, the wires being carefully concealed. The lamps were arranged in circuits to switch in and out with the prettiest effect imaginable.

The Callender Company has placed one mile of cable of 63 conductors, Nos. 14 and 18, in the wooden conduit running from Clark street to City Hall, Brooklyn. It is also filling some large orders for cables for electric lighting and telephony in the West. The company has lately added to the plant in its factory in order to meet the demand for its product.

The Guaranteed Electrical Work Company has opened an office at 205 Broadway, where it is carrying a supply of bells, burglar alarms, annunciators, door openers, medical batteries, experimental apparatus, lamps, etc. Mr. A. H. Weller, who is well known, is at the helm.

Howe, the photographer of Twenty-third street, has been taking some pictures of the interior of the house of Mr. E. H. Johnson, the President of the Edison Company. Two of the views shown were taken at night by means of Edison lights, run from Mr. Johnson's own plant in the basement of his residence.

Mr. W. P. Feeney, 14 Centre street, this city, is manufacturing a fine test oil which he calls "Journaline," and which is remarkably suitable for dynamos and high-speed engines.

Mr. Chas. K. Farmer, 36 Reade street, is introducing "Leatheroid" to the notice of electricians, and is enjoying great success in placing this new and remarkable insulating material on the market. If "Leatheroid" is all that is claimed for it—and it has undergone some very severe tests, substantiating the statements in regard to it—there are few departments of electricity in which it will not be in great demand.

Mr. Alexis Olenin, of the celebrated house of Hugo Bahr, Dresden, Germany, and Mr. H. E. C. Kemp, of this city, have organized a company here, at 39 Dey street, for the manufacture of the Bahr specialties—electrical optical apparatus for stage effects. Some of this apparatus has already been seen to great advantage by the New York public in the performance of the "Flying Dutchman," by the American Opera Company; and it is only natural that the excellent results should have attracted great attention on the part of the theatrical community. Indeed, I am told that some exceedingly novel developments in scenic effects are likely to be tried, now that playwrights and managers see what can be done. Mr. Olenin came to this country expressly to introduce the novelties, and is very hopeful of great success. I hear that the American company has a good financial backing. Mr. Olenin will have the management and Mr. Kemp will attend to the outside business. They will carry a full line of electrical goods and other specialties.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., May 17, 1886.

The Sprague Electric Railway and Motor Company has its New England offices established in the premises of the Edison Electric Illuminating Company, this city. Mr. H. McL. Harding, until recently manager of the Massachusetts Power Company, is the manager of the N. E. agency, and Mr. F. J. Sawyer, formerly in the employ of the Edison Company, is the special agent. Mr. E. W. Kellogg, until lately the head of the Lynn firm of electricians, Messrs. Kellogg & Co., is also associated with the Sprague Company. Already this company has received several orders for furnishing power to printing offices, elevators and machine shops, which are being filled as rapidly as wires can be put up.

The New York Insulated Wire Company, of 33 Oliver street, this city, and of New York, reports a good business in its specialties. It is sole owner of the Grimshaw wire patents, the Grimshaw tape and the Dowse underground system, and is equal to any demand arising from the new conditions affecting wires overhead or underground.

In the Massachusetts Senate, during the morning session last Friday, under the suspension of the rules, Mr. Gove, of Suffolk, presented the petition of the Chelsea Gas Light Company for authority to furnish electric lights in the city of Chelsea and town of Revere. Referred to the Committee on Manufactures. The Senate then concurred with the House in the suspension of the rules to allow the presentation of the petition of the Charlestown Gas Light Company also to furnish electric lights.

Messrs. Kimball & Davis, the new firm of manufacturing electricians, at 160 Portland street, this city, are preparing to light the hallways of their premises from an incandescent dynamo made by Mr. Kimball.

At the State House last week a new elevated railway movement awakened considerable interest and discussion, more particularly so at the hearings on the petition of Messrs. J. W. Chandler, M. D. Ross, Bainbridge Wadleigh, F. O. Prince and Geo. C. Barrett for incorporation as the Boston Elevated Railway Company. The City Elevated Railroad Company joins in the proposed new enterprise, and other contemplated movements in the same line will probably follow the example set by Mr. Joseph Bennett of the last-mentioned road.

The proposition is that the cars are to be propelled, warmed and lighted by electricity, with apparatus for lowering and raising patrons from the sidewalks at the stations to be worked by the same power. The bill provides that the gentlemen named above shall constitute the corporation known as "The Boston Elevated Railway Company" and that the corporation shall be in every way regarded as are the ground lines. The capital shall be $10,000,000, in shares of $100 each. The proposed routes of this electric elevated road start from Scollay square and run to Harvard square in Cambridge; also from Franklin Park, Boston, to Brookline; also from foot of Summer street to Milton. The fourth route is a belt line from the Boston & Lowell Railroad station, by way of the Eastern Railroad station, the Fitchburg Railroad station, the Boston, Revere Beach & Lynn Railroad station, the New York & New England Railroad station, the Old Colony Railroad station, the Boston & Albany Railroad station, the Boston & Providence Railroad station, thence to the place of beginning, all in the city of Boston. In addition to the usual arguments in favor of elevated roads, the petitioners for this new project claim that by using electricity instead of steam the annoyances of the elevated system are very greatly lessened. They claim to be able to put their electric motors, with a capacity of 45 horse-power each, under every car, and that weight being put upon the trucks, gives but 15 tons weight upon the drivers instead of 90 tons, as by steam in the present system.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, May 17, 1886.

A year or more ago City Councils passed an ordinance ordering all wires under ground, and specifying the restrictions and obligations incident to such a system. Nobody paid any attention to the ordinance, and no wires went underground, but when the limit of time elapsed Dr. Green, on behalf of the Western Union, wrote a protest, showing so lucidly the unfairness of the restrictions and obligations aforesaid contained in the ordinance that City Councils hesitated, extended the time for such work, and put on its considering cap. The result was that on Thursday last a Committee of Councils concluded to report favorably on another general ordinance—an improvement on the last one, but still "regulating" the laying of underground wires, conduits and cables sufficiently well to prevent any one from trying to lay them, in fact, inflicting certain penalties on any company having aërial lines attempting to place them under ground. The entire ordinance is worth reading, but I cannot give it space here. It directs that the laying of such underground systems shall be done under the supervision of the city's own officers; that whenever the city may desire to use or occupy *any* of the wires, conduits, cables or tubes, for municipal purposes, the company or persons to which the privilege has or shall hereafter be granted for laying or constructing such lines or branches, shall furnish the Electrical Department, upon thirty days' notice, with one or three good working conductors or wires not exceeding nine in number; or should the city, in lieu of using such conductors or wires, desire to place its own wires or conductors in any conduit or tube authorized to be laid or constructed, it shall have the authority to do so, in either case, without any cost or charge to the city; that they shall furnish *free service* to the city between such points as are or may be reached by their system; that in addition an annual license charge shall be made of $20 per running mile on all conduits, tubes or pipes for electrical conductors not exceeding 2½ inches in diameter; and on those not exceeding 6 inches, $40 per mile or part of a mile; and on those not exceeding 12 inches, $80 per mile or part of a mile; and on all other conduits, tubes or pipes for like purposes, not exceeding 15 inches, an annual license charge of $125 per running mile or part of a mile; and an annual license charge of $2 per mile, or part thereof, shall be made on all electric light wire or wires in use; and $1 per mile, or part thereof, shall be paid on all telegraph or telephone wire or wires in use which are laid under ground, whether singly or in conduits, cables, tubes or pipes; that said charges must be paid *in advance*; that said charges may be *increased* at any time by the city, and that each company shall give a bond in $10,000 for the proper care of the streets which they may open. Finally, the ordinance says, should any company or person to which privileges have been granted for the laying of underground wires, conduits, cables or tubes, dispose of any of the franchises granted by ordinance, or lease to, consolidate or merge with any other company, they shall forfeit all rights and privileges granted to them by the city of Philadelphia.

The "Electric Railway" on Ridge avenue, which was constructed about a year ago and suddenly dropped out of sight, is again attracting public attention. During the past week cars have been run on the Ridge avenue, between the depot at Twenty-ninth street and Laurel Hill Cemetery, by means of the new electric motor. The distance is inconsiderable, but the grades are heavy, and the conduits have been laid only between those points. It may be worth while to explain again the manner in which it is proposed to operate the road. The conduit, laid between the regular horse-car tracks, is only four and one-half inches wide by nine inches deep, and is laid on concrete, covered with a layer of Portland cement. Sewer connections at intervals permit the washing out of the slot and also carry off the rain water. In the conduit on each side of the slot is a copper conductor, one-fourth of an inch wide by one inch deep, on the bottom of which runs a grooved piece of cast iron. Running in the slot, supported by two wheels, is what is called a traveler. This is provided with two springs, which run along the cast iron on either side, receiving the electric current. The traveler is fastened to the car by small chains, and from its centre are wires extending up into the car, which connect the motor carried on the car with the generator. Of the two conductors in the conduit, one carries the current from the generator to the motor, the other from the motor to the generator. A regulator in the car

controls the electricity, so that the car may go forward or backward. A brake acting on the wheels is an additional safeguard. An engine at the depot will furnish the necessary power. The estimated cost per day of running the electric car is $1.84, while the cost per day of operating a horse car is $4.74. Both estimates are exclusive of salaries. It is calculated that an electric railway ten miles long and having fifty cars would cost $147,400.

The American District Company here seems to be as fickle as our spring weather. Some time ago that company cut loose (for the second time) from the Western Union, and joined hands with the Baltimore & Ohio. Last week the American District fell out with the Baltimore & Ohio, and has effected a working arrangement with the Postal Company, and hereafter, it is announced, all messages left at the American District offices for transmission to other cities will be sent over the wires of the Postal Telegraph Company, and all Postal messages received in this city will be delivered by the American District messengers. The new arrangement is for a long term of years.

On Tuesday last the United States Circuit Court granted a preliminary injunction to the American Bell Telephone Company, restraining Albert F. Congdon from making, selling and using an alleged infringement upon the plaintiff company's patent.

The first trial of street illumination by electricity was made in Camden, N. J., last Saturday night. The Electric Light and Heating Company illuminated Federal street. The company will furnish the light gratuitously for a time, with the hope of having the city make an appropriation for it.

The Philadelphia & Reading Railroad Company has constructed a novel car for use in furnishing electric lights at the Mahanoy plane, so that the workmen can have the benefit of strong lights in working at night in finishing the new plane buildings and putting in the machinery, as the work is to be prosecuted day and night. The electrical machinery is in one part of the car, a steam boiler in the other, and the water tank is attached to the end of the car outside. It is a locomotive, car and electric light plant on wheels.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, May 15, 1886.

The Western Electric Company are doing excellent work in the electric lighting field. They aim to keep their products in this line up to the high standard maintained in other departments, and to furnish in every instance first-class apparatus only. They have lately secured the city contract at Defiance, O., fifty lights; Alliance, O., has ordered an additional machine: a twenty-five lighter has just been sold to go to Clay Centre, Kas.; the Janeville, O., plant will probably be running by the time this appears in print; and another twenty-five lighter is just being furnished South Chicago. Work is brisk with them in other departments, and an underground cable order for Pittsburgh, Pa., is worth special mention.

The Fort Wayne Jenney Electric Light Company has just opened an office in the basement of the Montauk Block, Chicago, under the management of Mr. W. J. Buckley. The Fort Wayne Company is doing an immense arc lighting business in the West, and with the opening of the new office here the territory contiguous to Chicago will receive even closer attention then heretofore.

The Brush Electric Company's Chicago office has removed to very convenient quarters on the ground floor at 130 Washington street. Mr. Alex. Kempt, the company's courteous agent here, informs me that business is good with him, and that the prospects are all that could be desired. Mr. Kempt is arranging for a very attractive display in the street window of his office.

The Union Telephone Company have purchased the business of Messrs. S. Harbert & Co., 88 La Salle street, Chicago, and will continue to manufacture and sell the well-known Harbert short-line telephones. They will remain at the old place.

Col. S. G. Lynch, broker, whose stock quotations appear from time to time in this column, has removed to 146 La Salle street, where he will be pleased to see customers and acquaintances. The colonel, who is an authority on these matters, regards all telephone stocks, without exception, as good purchases at the present depressed prices.

The Williams engine, Mr. Ed. F. Williams inventor, is an engine which I expect to see assume a prominent position soon for electric light use.

Mr. Geo. S. Bowen has probably done as much as any other one man for electric lighting, and his labors in this direction have made his name familiar to electricians the country over. Mr. Bowen's career in Chicago has been a remarkable one, and it will be interesting to those occupied in the business in which he is now engaged to read the following from a dry goods paper concerning his connection with that trade:

"It is astonishing how well some men bear their age; how even after an average lifetime spent in assiduous toil, they still look hale and young. A striking example of this class of men is George S. Bowen, whom our readers will remember as having been in years agone one of the merchant princes of Chicago, and in his day the Marshall Field of the West in the wholesale dry goods trade. Mr. Bowen came to Chicago in 1849, and began his mercantile career in this city as a clerk for N. H. Wood, who was then in the wholesale dry goods trade on Lake street. In March, 1853, Mr. Bowen, with others, purchased the business from Mr. Wood, and the new firm assumed the name of Mills, Bowen, Dillenbeck & Co. Three years later it became Bowen Bros., at which time the business was removed to Nos. 72, 74 and 76 Lake street. In 1858, their business having wonderfully increased, the Bowen Bros. leased the McCormick Building, at Nos. 19 and 21 Lake street, for an annual rental of $4,500. Here they remained until 1863, when Mr. McCormick gave the firm his check for $30,000 as a bonus to induce them to relinquish their lease and vacate the building. They accepted his offer and at once erected a block on Randolph street, east of Dearborn, where they were at the time of the great fire in 1871. In this conflagration the firm of Bowen Bros. lost $1,500,000, and this, in connection with business troubles following the panic of 1873, ended the existence of a house which, up to that time, was one of the oldest and largest of its kind, not only in Chicago, but in the West. An idea of its growth and development may be had from the statement made by Mr. Bowen, that in 1853 they did a business of about $1,000,000, but which in 1871 had increased to $6,500,000 per annum. In addition to the facts above given, it may also be of interest to state that Chicago has had few citizens possessing more public spirit, and who have labored harder for its advancement as a commonwealth, than has George S. Bowen. During the active period of his business career there were few enterprises of a public character, especially those tending toward the advancement of the city's commercial welfare, in which he was not thoroughly identified, and not infrequently as a founder and prime mover. After the fire and panic had in a measure swept away his fortune, Mr. Bowen, shattered in health, went West, where he remained for some time. But a man of his indomitable will and untiring energy does not long remain idle, and of late years he has been actively engaged in building railroads and various other enterprises here in the West. He is now at the head of a large corporation formed to push and develop certain electrical patents, and will, I am told, soon be again permanently located in Chicago."

Mr. Bowen is now the active manager of the Universal Electric Company, whose office is at 196 Jackson street, and whose works are being erected on the North Side, corner Division street and Elston road.

The following is the account given by a Cleveland dispatch of a recent telephone test between that city and New York: A public telephone test was given this afternoon between this city and New York by Count Mitkiewicz, representing a Baltimore invention. The wires were made up so as to make as long a distance as possible, and covered a circuit of 1,600 miles. A very large and select party of capitalists, etc., witnessed the test, a special feature of which was the singing of Miss Emma Abbott and Miss Bellina, of the Abbott Opera Company, both of whom were interested witnesses of the test. Seven receivers were attached at one time, so that that number of persons could hear at the same time. Songs were also sung by the parties at New York, all of which was most distinctly heard by every one at this end. A test across the Atlantic Ocean will be made as soon as the parties, who are now on their way, reach Liverpool with the instruments.

Van Depoele arc lighting plants have lately been put in operation at Texarkana, Ark., and Shreveport, La., sixty lights in each place. Also 60 lights at Denison, Tex.

Mr. W. M. Thomas, of Grand Rapids, Mich., inventor of the Thomas system of electric lighting, was in Chicago this week. The Farmer Roller Mill Company, who handle Mr. Thomas' patents, have already installed a comparatively large number of plants, and I have yet to hear of an instance where the lights have failed to give satisfaction.

The new shop of Mr. Foree Bain, which was mentioned in this column two weeks ago, will be in operation at 95–97 Indiana street before this appears in print.

The American Electric Manufacturing Company have removed from 90 Lake street to 117–119 Lake street, where they have larger and more convenient quarters and better accommodations in every way.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, gives the following telephone stock quotations:

Bell of Mo.	$147@$150
Chicago	350@ 360
Central Union	40@ 45
Colorado	18@ 20
Cumberland	65@ 70
Great Southern	25@ 27
Great Southern Scrip, 65 cents on the dollar.	
Iowa Union	15@ 18
Michigan	64@ 66
Mo. & Kan.	53@ 55
Mo. & Kan. Scrip, 53 cents on the dollar.	
Rocky Mountain Bell	40@ 45
United	15@ 17
Wisconsin	107@ 109

W. A. K.

THE TELEGRAPH.

A Relic of Barbarism.—The semaphore on the top of the Government house at Portsmouth, England, has been abolished by the Naval Commander-in-Chief, and communication by means of telephones adopted in its stead.

Cable Revenues.—Mr. Pender, presiding at a meeting of the Submarine Cable Trust in London on May 12, stated that the revenue thus far for 1886 was £4,655 less than that of the same period in 1885, in consequence of the diminished dividends of the Anglo-American Cable Company and the competition of the Commercial Cable Company.

Objectionable Steam Pipes.—A preliminary injunction has been obtained by the Commercaal Cable Company from Judge Donohue, in Supreme Court Chambers, restraining the New York Steam Heating Company from laying steam-pipes in Nassau street, within three feet of its cables, which have hitherto, it is said, been injured by the too close proximity of steam pipes to them.

No Exceptions Allowed.—On the application of the Baltimore & Ohio Telegraph Company, Judge Stewart, sitting at Baltimore, has issued a mandamus compelling the Chesapeake & Potomac Telephone Company to rent telephones to the telegraph company for usual message service, notwithstanding the exclusive contract with the Western Union. The Baltimore & Ohio people say they propose to fight on this point all along the line.

Canadian Pacific Telegraphs.—A special dispatch of May 12 from Montreal says: The stock of the Montreal Telegraph Company bounded up about 7 per cent. to-day on the strength of certain rumors. One report was that the Canadian Pacific had assumed the Western Union lease of the Montreal and Dominion Telegraph companies lines, and that a monopoly of the telegraph business in Canada would be held by the Canadian Pacific. Another rumor was that pooling arrangements had been entered into between the Canadian Pacific and the Western Union. All the information that can be got from the Canadian Pacific officials on the subject is that their company desires to work harmoniously with all competitors.

Confirming a Telegraph Sale.—Upon the application of Thomas Leaming, representing Albert D. Chandler and Henry Rosener, the Receivers of the Postal Telegraph and Cable Company, Common Pleas Court, at Philadelphia, on May 15, made a decree approving and confirming, so far as Pennsylvania property of the company is concerned, its recent sale to Edward C. Platt, under a decree of foreclosure of the Supreme Court of New York. The decree also confirms the deeds to Mr. Platt and the delivery of possession to him. The only Pennsylvania creditor is Eugene M. Howell, who secured a judgment against the company for $127,326. The sale is confirmed subject to the lien of that judgment, the interest in which has already been transferred to Mr. Platt.

A Costly Failure to Deliver.—Before Justice Cullen, in the Supreme Court in Brooklyn, on May 15, L R. Dixon & Co., contractors, began suit against the Western Union Telegraph Company for $400,000 damages, alleged to have been sustained because of the failure of the defendant to deliver a dispatch directed to the Police Director of Guatemala. The message read: "Pratt, Guatemala. Coming. Will business wait?" For its transmission the plaintiffs paid the telegraph company $4.70. When Mr. Dixon arrived in Guatemala, however, he ascertained that the message had never been delivered, and that as a consequence his firm had lost a contract to build a railroad, by which it is claimed they would have cleared the amount of money asked for in damages. The company, through its counsel, moved yesterday for the dismissal of the action on the ground that the direction of the telegram was so indefinite that the defendant could not be held responsible for its non-delivery. The motion was denied.

The Cable War.—News dispatches from London have the following: A gentleman who is disinterested as regards the cable companies' quarrel has been making inquiries here as to the business results of the change in the tariffs. He says the Combined company's business has increased at the sixpenny rate among a poorer class of customers only, who would not otherwise cable at all. The Commercial Company has also increased for various causes. Some of the increase comes from the old-fashioned bankers and others who are afraid of the insecurity of the combined company's work consequent on a supposed rush because of low prices, and who prefer the safety of the Commercial at a higher rate, while others, foreseeing a future loss, wisely prefer a moderate to a suicidal rate. It is stated that the new North and South American cable will be laid via the Azores and Bermuda. It is calculated that owing to the present cheapness of cable material and the reduced risk and damage consequent on mid-ocean landings, it will be able to transmit at low rates.

THE TELEPHONE.

Newark, N. J.—The recent decision in the Domestic case is to be taken by the Metropolitan and New York & New Jersey companies to the Court of Errors and Appeals.

A Telephone Meter.—The Tabony Public Telephone Company, of New Orleans, proposes to open 300 public telephone stations in that city, and to charge five cents for each five minutes or fraction thereof; also to rent telephones to private parties at the rate of one cent per minute while actually in use. The amount of use during each month is to be registered and indicated by the Tabony telephone meter.

Results of the Pan-Electric Inquiry.—The Pan-Electric inquiry is regarded as practically closed. The report of the committee will be presented to the House by the middle of June. The majority report will exonerate Mr. Garland from all blame on account of his connection with the Pan-Electric Company. But it is expected that the Chairman will question, in this majority report, the propriety of public men engaging in speculative enterprises, although he will not cast any reflections on the integrity of the public men who are concerned in the Pan-Electric scheme. It is understood that the report will also exonerate the Attorney-General from all complicity in bringing the Government suit. Upon the other hand, the minority report will be as stout an arraignment as the legal ability of Mr. Ranney will be able to prepare. It is evident that the Republican members of the committee regard the Pan-Electric scheme as a scandalous gift enterprise, and that the public officials connected with it were given their interests on account of their names. They will find further that these public officials merit censure for using their official influence to advance the fortunes of the company. The Republican minority will also report its belief that the Attorney-General is not above criticism in the methods employed in bringing the Government suit.

THE ELECTRIC LIGHT.

Fort Madison, Ia., is to have its penitentiary lighted by electricity.

North Attleboro, Mass., was to have its system of electric lighting ready by the 15th.

Saco, Me., has a Ball company with a capital stock of $300,000. The President is Austin C. Dunham of Hartford, Conn.

York, Pa.—The People's Electric Light Company of York, Pa., has a capital stock of $25,000. The treasurer is Mr. Jas. H. Schall.

Sharon, Pa.—The Sharon Electric Light Company, Sharon, Pa., has been incorporated. Capital stock, $5,000. Treasurer, S. C. Simonton.

Ripon, Wis.—The Ripon (Wis.) Lighting Company has been incorporated by T. Higgins, H. C. Cody and E. H. McNeil, with a capital stock of $25,000.

Fairfield, Me., is well pleased with the incandescent light in its stores and dwellings. Some 250 lamps are running. Mr. A. F. Gerald is manager. The dynamo is driven by water power.

Westinghouse Plants.—The Westinghouse Electric Company has just closed contracts for a central station of 1,200 lights of 16 c. p. at Schenectady, N. Y., and for 1,500 lights for the Keystone Electric Company, Philadelphia.

Hornellsville, N. Y.—About a month ago mention was made in these columns of the proposed plant for the above town. The American Illuminating Company, of Hornellsville, has now been incorporated, with a capital stock of $35,000.

PERSONALS.

Lieut. Bradley A. Fiske, U. S. N., has been detailed to duty on the cruiser "Atlanta."

Mr. John Hoey, of the Adams Express, is now mentioned in connection with the vacant Commissionership of Electrical Subways. Mr. Hoey does not enjoy the reputation of a distinguished electrician, but in almost every other respect he stands high in public estimation.

Dr. Werner Siemens has placed at the disposal of the German Government the sum of nearly $120,000 with which to establish an institute for carrying on experiments in natural science. It is proposed to erect a building in which studies in exact science may be prosecuted.

Mr. Matt Buell, the repeater chief of the Western Union Company, at Buffalo, read a paper recently before the local Electrical Society on "Thunder and Lightning." The paper was highly interesting and was well received, provoking a brisk discussion on the best form of lightning conductors.

Mr. W. H. Boulton, the well-known founder of the Boulton Carbon Company, resigned his position as general manager about a year ago. He is now entering again the business with which his name is so familiarly connected, and is fitting up a new carbon factory at Cleveland, with improved machinery, to make a special and superior article. The name of the new concern with which Mr. Boulton is connected will be the Boulton Standard Carbon Company, and it is understood that the product will soon be put on the market.

Dr. Otto A. Moses has succeeded Mr. Frank Ridlon as chairman of the committee of the National Electric Light Association on its proposed Bureau of Information. The plan originated with Mr. Ridlon, who, however, finds himself too greatly occupied with business cares to carry out its details. In the selection of Dr. Moses, who is willing to serve, a happy choice has been made. It may not be generally known that Dr. Moses was at one time prominently connected with a like bureau established by the Edison Company for its own guidance amid the many and growing ramifications of its large business.

Mr. George G. Ward, the able and courteous general manager of the Commercial Cable Company, in this city, is receiving great encouragement in the fight his company makes against the "pool," and finds that the public support is both large and ready. It must be regarded as a fortunate thing for the Commercial Company that its interests here are in the hands of Mr. Ward, who is not only a faithful and careful executive officer, conversant with all the complex details of internal working, but enjoys remarkable popularity in the electrical profession and among the leading representatives of New York financial and commercial interests.

APPLICATIONS OF POWER.

Kansas City.—Among the projected improvements to Kansas City we learn of a double-track street railway to be built from Tenth and Main streets, east on Tenth to Brooklyn avenue, then south on Brooklyn avenue to the city limits—in all a distance of about three and one-half miles. The gentlemen interested in the completion of this road are large property holders in the neighborhood of which the contemplated railway will run. The parties proposing to build say that of the new franchises lately issued by the Council of Kansas City for cable or electric roads they will be the first to run a car, the only question with them being as to the entire ability of the electric motor to give an efficient service upon the somewhat difficult grades they have to encounter. John B. Stone, Henry B. Pain, Henry N. Smith, Jr., William E. Ridge, Alex. Frazer and John T. Blake are the incorporators.

MISCELLANEOUS NOTES.

Suicide of an Electrician.—Mr. W. H. Prentice, an electrician of Utica, committed sucide on May 13 by hanging himself in his shop. He was 55 years of age.

The Minnesota Electric Time Company has been incorporated for Minneapolis with a capital stock of $100,000. Mr. J. J. McCafferty, No. 90 Court Block, St. Paul, is one of the incorporators.

An Accounting Asked for.—Mr. T. G. Magill, as former partner of Mr. D. H. Dorsett, has begun suit in Chicago for an accounting of the affairs and profits of the Dorsett Conduit Manufacturing Company.

American Institute of Electrical Engineers.—The second annual meeting of the American Institute of Electrical Engineers was held on the evening of the 18th inst., in the rooms of the American Society of Civil Engineers, at No. 127 East Twenty-third street. The officers for the ensuing year were elected and the preliminary business disposed of preparatory to the general meeting, which was held next day. The officers elected were: President, F. L. Pope; Vice-Presidents, Dr. Norvin Green, Thomas D. Lockwood, George C. Maynard and Prof. W. A. Anthony; Managers, C. O. Mailloux, Sidney F. Shelbourne, Capt. O. E. Michaelis and Prof. C. F. Brackett; Secretary, R. W. Pope; Treasurer, Col. R. R. Hazard. On the 19th several papers were read.

A Big Battue.—A dispatch of May 10 from Chicago says: A strange phenomenon occurred during the storm of Saturday night in the vicinity of the Board of Trade tower light. It was none other than a shower of birds. Yesterday, when the watchman made his rounds, he found the sidewalks and streets in front of the tower fairly covered with dead birds of all sorts. A little later the electrician came down, and when he saw the great piles of birds he said that they had been killed by the electric light at the top of the tower. When he went up to the lantern with several members of the Board of Trade the roof was found to be covered with dead birds. These birds are of every known variety, and many unknown or rather unfamiliar species are among the lot. All shades and colors are there—scarlet, blue, pink, red, canary, mottled black and white, and there were some snipe and plover among them. The theory is that they were migratory flocks going from South to North, and were attracted by the great light, which killed them the moment they touched it. There was a countless number of them, enough to trim all the ladies' hats in Illinois.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Western Union, b 61¼, a 62.

Telephone.—Am. Bell, b 158, a 159; Erie, b 25¼, a 26; New England, b 31, a 32.

Electric Light.—No new quotations.

SPARKS AND FLASHES.

An Electrical Effect.—Governor McEnery, of Louisiana, recommends that capitally convicted criminals shall be executed by some means more humane than hanging—possibly, as has been proposed, by electricity, but in a well-conducted hanging the effect is electrical.

A Stammering Ticker.—Mr. Travers and Mr. Walden, the well-known Wall street brokers, stammer in perfect accord. Mr. Travers was in Mr. Woerishoffer's office the other day looking at the stock indicator, when the instrument got out of kilter, and the letters came out jerky and illegible. "Vat's de matter mit de dape," asked Mr. Woerishoffer. "G—g—guess Wa—a—lden's t—trying to t—t—talk to me," was the reply.

BUSINESS NOTICES.

Hill's Hair and Whisker Dye
Colors to any natural shade of black or brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure; 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

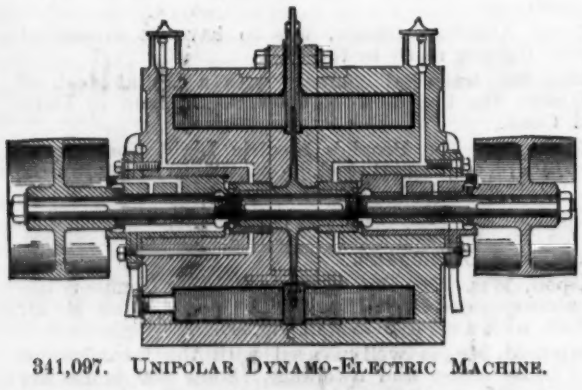
PATENTS DATED MAY 4, 1886.

341,000. Telephone; James T. Guthrie, Leesburg, O. Consists in a receiving telephone composed of a suitable trumpet-like case, a metallic diaphragm mounted across the enlarged end of said case, and a permanent magnet arranged within said case to attract the diaphragm, and having a coil of insulated wire mounted on each end, said coils being connected in multiple arc to two common terminals arranged for circuit connection.

341,059. Electric Light System; William M. Schlesinger, Philadelphia, Pa. Consists of a new disposition of compensating resistances adapted especially to railway trains.

341,092. Thermo Regulator; Albert M. Butz, Minneapolis, Minn. There are two open circuits, a furnace and an alarm, and electrical connections between the same and a thermostat.

341,097. Dynamo; Sebastian Z. de Ferranti, West Kensington, England. A cross-sectional view is shown in the cut, the machine being unipolar.



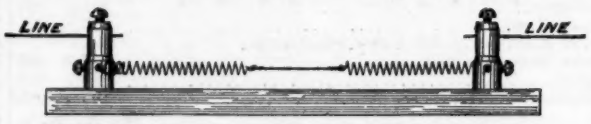
341,097. UNIPOLAR DYNAMO-ELECTRIC MACHINE.

(1) 341,110, (2) 341,111. Clock Synchronizer; James S. Ross, Nashville, Tenn.

1. Consists of a clock, an electric synchronizing device embodied therein and acting thereon, and an automatic switch for placing the synchronizing device in and out of circuit operated by the concurrent action of two devices moved by the train, one acting with greater frequency than the other.

2. Consists in combining with a subscriber's line or a series of subscribers' lines at the central office a regulator which acts at the predetermined time, first, to disconnect the subscribers' lines from the switch-board and connect them with an open ground-line containing a resistance coil and a battery or generator, and, second, to close the ground-line in order that an impulse or current may be transmitted over the subscribers' lines to effect the adjustment or correction of the local or subscribers' regulators located thereon.

341,114, 341,115. Fire-Alarm System; John C. Wilson, Boston, Mass. They are closely related, the latter being described thus: The releasing-magnets of a considerable number of signal-boxes that are located in a group or near together, as in the different stories or apartments of a large building, are included in a local circuit, and normally-closed shunts are provided for each of the magnets, having suitable circuit-breakers, each of which when operated opens the corresponding shunt and causes the current to pass through the releasing magnet in the local circuit. The releasing-magnet of one of the boxes has no shunt, the magnet being normally charged, and the box being released by the demagnetization of the magnet, which takes place if the local circuit is broken or grounded or otherwise injured

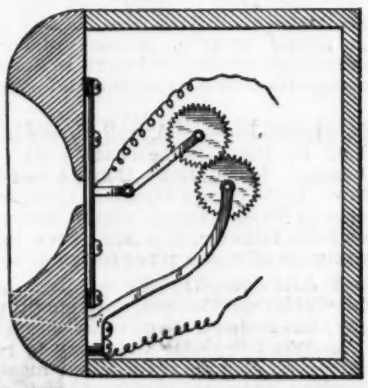


341,289. SAFETY DEVICE FOR ELECTRIC WIRES.

or deranged in such a manner as to interfere with the operation of the other boxes.

341,128. Electrical Connection; George D. Burton, Boston, Mass. The device is clearly shown in the cut.

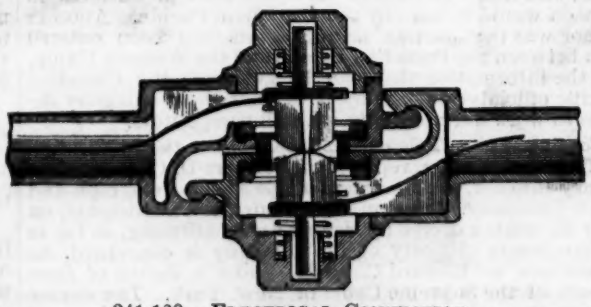
341,259. Telephone; William Marshall, New York, N. Y. Consists of a condenser punctured as to its leaves.



341,264. TELEPHONE TRANSMITTER.

341,263, 341,264. Telephone Transmitter; James F. McLaughlin, Philadelphia, Pa. In both, gear-wheels having operating connection with the diaphragm are provided, as illustrated in the cut.

341,289. Safety Device; Edwin B. Temple, Everett, Assignor to the American Bell Telephone Co., Boston,



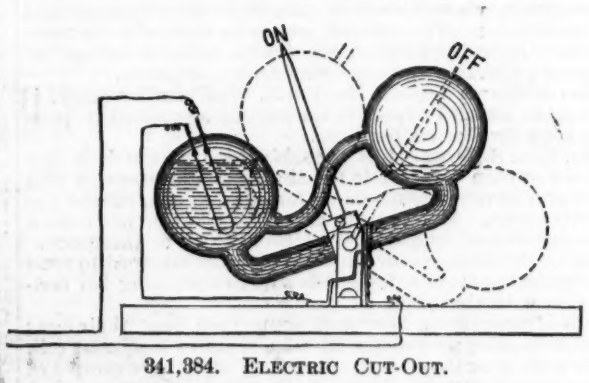
341,128. ELECTRICAL CONNECTION.

Mass. Consists of two helical springs connected by a fusible wire, as shown in the cut.

341,291. Track Instrument; Charles D. Tisdale, Boston, Mass., Assignor by mesne assignments to the Standard Electric Railroad Signal Company, New York, N. Y. Consists in a curved bar or rail resting on the ties and pressed toward the inner surface of the railroad rail by means of strong springs, and located with reference to the rail so that the flange of the wheel of the passing train will pass between the railroad rail and the spring-acted bar and move it laterally, so as to draw a cable extending through a pipe to an electric-circuit breaker or closer, which is operated by motion imparted to it by the cable.

341,293. Push Button; Samuel Vanstone, Providence, R. I., Assignor of one-half to George Hancock, same place. Consists of the usual base provided with a central raised portion having a curvilinear groove or grooves and opposite cut-away portions, and of a cap-piece combined with the base and adapted to fit thereon, and provided with inwardly projecting studs or pins, which are adapted to be passed over the cut-away portions and be turned into the grooves to retain the cap in place on the base.

341,303. Steam Dynamo; Leonidas G. Woolley, Indianapolis, Ind., Assignor to Henry H. McGaffey and Chester Bradford, both of same place. The steam engine is secured to the magnetically neutral portion of the dynamo.



341,384. ELECTRIC CUT-OUT.

341,368. Steam Governor; Edward H. Amet, Chicago, Ill. Assignor to H. A. Streeter, same place. Consists of detail improvements upon his patents 326,934, of Sept. 29, 1885, and 292,397 of Jan. 22, 1884.

341,370. Telephone; Fred. H. Brown, Fort Worth, Texas. The number of coils in the transmitting instrument is greater than in the receiver.

341,384. Cut-Out; Adam Lüngen, New York, N. Y., Assignor to Edwards & Co., of same place. The device is shown in the cut. The fluid is caused to shift from one end of the tube to the other by means of gas generated in one of the bulbs from the fluid by causing the electric circuit to pass through a conductor within the bulb of such resistance that it will become heated by the passage of the current, the balancing fluid being so volatile as to easily be converted into gas.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, 9 Murray st., New York.